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GREATER TORONTO AREA 3Rs ANALYSIS

SERVICE TECHNICAL APPENDIX

DRAFT - NOVEMBER 1993

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SERVICE TECHNICAL APPENDIX

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for
Fiscal Planning and Information Management Branch
Ministry of Environment and Energy

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1.0 INTRODUCTION

1.1 Background

In 1989, the government of Ontario announced its commitment to meeting a Provincial target of at least 50% reduction of waste going to landfills and incineration by the year 2000. This target, a waste **diversion** target to be achieved through waste reduction, reuse and recycling (the 3Rs) was confirmed by the present government in 1990.

To facilitate the achievement of the 50% target, the Province introduced the *Waste Management Act, 1992*. The Act broadens the government's powers to reduce waste sent to disposal through a variety of means. It also vests powers in the Interim Waste Authority (IWA), an agency created to ease the waste disposal crisis in the Greater Toronto Area (GTA). The IWA is complying with its mandate by conducting environmental assessments to locate three, long-term landfill sites in the GTA.

The GTA Regional Municipalities of Peel and Durham are each defined for the IWA process as separate "primary service areas". Metropolitan Toronto and the Regional Municipality of York have been defined as a separate **combined** primary service area. Each of the three defined primary service areas is proposed to receive one new landfill facility identified through the IWA's process. The fifth GTA Regional Municipality, Halton, has already obtained approval for a landfill site and thus is not part of the present siting process.

1.2 Purpose of Study

This study has two purposes, each of which relates directly to a requirement created by the *Waste Management Act*.

The first requirement pertains to waste estimates. Section 14 of the *Waste Management Act* requires the Minister of Environment and Energy to provide a written estimate as to:

a) *the amount of waste that would otherwise be expected to be generated in the primary service area (i.e. each of Peel, Durham and Metro/York) during a twenty-year period that will not be generated because of waste reduction efforts; and*

b) *the amount of waste that will be generated in the primary service area during a twenty-year period that will not need to be disposed of in the site because of the reuse or recycling of materials that are or could become waste.*

These waste estimates were provided to the IWA by Minister's letter dated May 15, 1992. The current study provides additional analysis of 3Rs activities, in support of the waste diversion estimates previously provided.

The second requirement pertains to analyzing the 3Rs as "alternatives to" landfill waste disposal sites. Section 15 of the *Waste Management Act* requires that the IWA environmental assessments contain a description of, and statement of rationale for the 3Rs, as well as evaluate matters relating to the 3Rs as an alternative to the landfill waste disposal sites. By administrative agreement, MOEE committed to provide such a rationale and evaluation to the IWA for use in its environmental assessments. The present report fulfills this second requirement.

1.3 Study Approach

The GTA 3Rs Analysis identifies and assesses alternative 3Rs systems, comprised of combinations of 3Rs programs, technologies and practices, that could reasonably be implemented in the GTA. It also determines the potential for each 3Rs system to divert waste over the twenty-year minimum life expectancy of the GTA landfill sites, and identifies the advantages and disadvantages of each system.

For purposes of the present analysis, an array of conceptually different 3Rs systems have been identified for addressing residential wastes, as well as for industrial commercial, and institutional (IC&I) wastes. For each system, estimates of the amount of waste the system could potentially divert from disposal have been determined. An assessment, done on a non-site-specific, generic level and documented in this report, identifies the advantages and disadvantages to the environment of each potential 3Rs system, in keeping with the *Environmental Assessment Act*.

In conducting the 3Rs work, and providing estimates of waste that will not require disposal in the IWA established sites, MOEE is acting as a reliable authority in accordance with its legislative mandate, and not as the proponent or co-proponent of any of the 3Rs systems discussed. The alternatives presented in this report are not in any way structured as detailed implementation plans for the Regions or the private sector.

1.4 Purpose of the Service Assessment and Study Objectives

This technical appendix documents the service input into the GTA 3Rs analysis. Service effects in this study are defined as potential for alterations to waste disposal (due to changes in waste generation, composition or disposal) which may occur as a result of the implementation of a 3Rs system within each of the

four Regional municipalities (Durham, Metro Toronto, York and Peel). The results of this assessment serve as input into the overall 3Rs system evaluation.

The study objectives of the service assessment are as follows:

- Identification of existing waste management and diversion systems in each of the four regional municipalities;
- Prediction of service (waste generation, composition and diversion) effects as a result of implementation of any of the alternative 3Rs systems within each of the four Regional municipalities;
- Analysis of the potential effects on service, including the development of mitigation measures for the purposes of identifying net effects;
- Ranking the systems of the four Regional municipalities from the perspective of service.

1.5 Outline of Report

Chapter 2 presents the study approach followed in the Service assessment.

Chapter 3 presents residential waste generation estimates and projections, as well as waste composition estimates for the Regions of Durham, Metro Toronto, York Peel and Halton.

Chapter 4 provides a discussion of alternative waste diversion systems and residential system diversion estimates for the Regions of Durham, Metro Toronto, York and Peel.

Chapter 5 presents waste generation and composition estimates for the IC&I sector in the GTA.

Chapter 6 discusses alternative waste diversion systems for the IC&I sector and provides estimates of waste diversion achievable by each of the systems, on a GTA-wide basis.

Chapter 7 details the net effects analysis process undertaken by the Service discipline. The six alternative systems are measured and compared for the residential sector (on a region by region basis) and for the IC&I systems (on a GTA-wide basis) according to established criteria.

Chapter 8 presents residential and IC&I waste generation, reduction and diversion estimates for the Regions of Durham, Metro Toronto, York and Peel, for the years 1996 to 2015. Estimates of a wide range of possible waste diversion

impacts that could be achieved through different combinations of residential and IC&I systems are provided.

2.0 APPROACH AND METHOD

2.1 Introduction

This chapter describes steps that were taken to develop alternative 3Rs systems for the residential and IC&I sectors. In addition, it briefly describes the study approach used.

2.2 Waste Diversion System Development Process

A range of 6 residential and 6 IC&I waste diversion systems were developed for comparison in the GTA 3Rs Analysis. In order to conduct this analysis, a methodical process of system development was undertaken. The objective was to combine a wide range of alternative waste diversion components into logical systems which could potentially be used for waste diversion, without undue complexity, throughout the GTA. The method used for system development is illustrated in Figure 2.1.

The systems were developed to provide a basis for comparing alternative waste diversion approaches. **No attempt was made to analyse all possible systems, nor was this an attempt to provide conclusive recommendations of preferred systems for waste diversion in GTA Regions. The range of alternative systems developed were however considered to be reasonable for the GTA. It will also be the municipalities themselves who decide which system is most appropriate considering their own local issues/conditions.**

The system development process consisted of six steps:

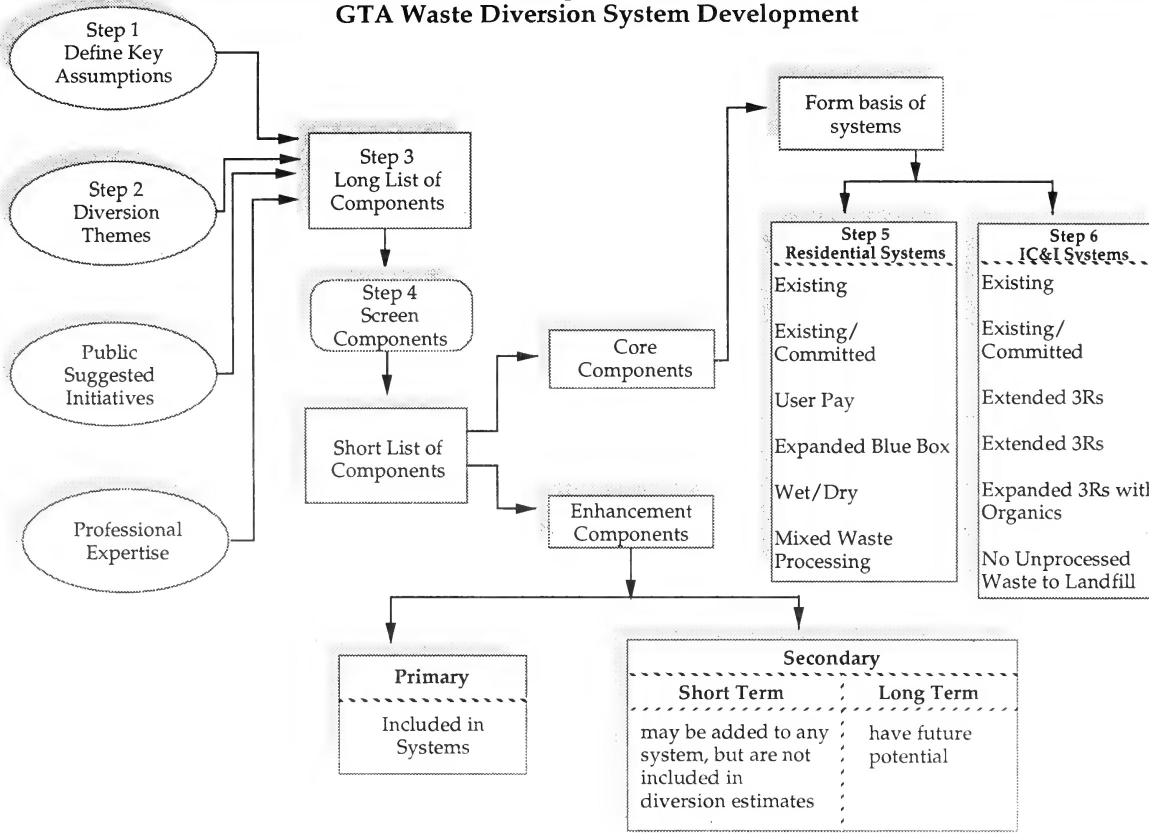
1. Defining Key Assumptions
2. Identifying Waste Diversion Themes
3. Identifying Long List of Components
4. Screening Long List of Components
5. Developing Potential Alternative Residential Waste Diversion Systems for the GTA.
6. Developing Potential Alternative IC&I Waste Diversion Systems for the GTA.

Tasks involved in the process are detailed in the following sections.

2.3 Step 1: Defining Key Assumptions

Several assumptions were necessary in order to suggest alternative waste diversion systems that might be applicable to the GTA. The assumptions developed for this purpose are as follows:

Figure 2.1
GTA Waste Diversion System Development



- The Existing System would be included in the analysis as the "do nothing" alternative. It would be defined as the 3Rs system in place within each regional municipality as of December 31, 1992;

- Commitments made through five year Regional and municipal budgets and Federal and Provincial policies announced by 31 December 1992 were considered likely to occur, and were termed the Existing/Committed System. While each of the four Regional Municipalities would be affected by the same Federal and Provincial commitments, they differed with respect to Regional, municipal and private sector commitments;

- A "long list" of waste diversion components would be developed (as explained in Section 2.5.1). This would be a list of any components that *could* theoretically be applied in any or each of the GTA Regional Municipalities for waste diversion;

- Residential and IC&I waste diversion would be analysed separately for each GTA Region. However, because there is no effective waste management boundary for IC&I waste and recyclables (IC&I waste management crosses municipal boundaries), IC&I systems would be developed for the GTA as a whole.

2.4 Step 2: Identifying Waste Diversion Themes

A set of seven waste diversion themes were developed as one of several inputs to the development of the long list of components. The themes helped highlight elements that *could* be included in waste diversion systems. A review of 3Rs initiatives suggested through the SWEAP, SWISC and IWA public consultation processes, as well as a review of comparable systems in Ontario and world-wide systems, contributed to development of a wide range of alternative waste diversion themes.

The themes described various approaches to waste diversion. Any of these themes *could be* added to present activities in the regions. The themes considered included:

1. Comprehensive Source Separation without Central In-Vessel Composting
2. Wet/Dry Collection and Processing
3. End of Pipe, Mixed Waste Processing
4. Product Stewardship
5. Economic Instruments
6. Promotion/Education, and
7. Generator Based Source Reduction and Reuse.

The themes are described below.

Comprehensive Source Separation Without Central Composting

A comprehensive source separation theme would involve separating the waste stream into a number of different categories at source. It would maximize the benefits of Existing residential systems for waste diversion in the GTA without precipitating major changes for householders from current operations. Existing dry recyclables collection and processing programs would be built upon to manage and divert as many dry recyclables as possible. This theme would be supplemented by aggressive promotion of backyard composting and separate collections of leaf and yard waste which would divert components of the "wet" waste stream. At IC&I locations, comprehensive source separation would focus on dry recyclables and would increase source separation efforts being carried out by many IC&I locations on a voluntary basis at this time.

Comprehensive source separation may be applied to any element of the waste stream. An expanded array of dry recyclables (to include such materials as textiles, aluminum foil, OCC, wood, etc.) would be separated at source in homes and IC&I locations. Existing household containers and waste/recyclable collection systems would continue to be used for collection of recyclables, etc. Existing recycling systems would be expanded to collect and process an increased supply of dry recyclables.

Wet/Dry System

The term "Wet/Dry" refers to a residential solid waste collection program where the householder is required to separate their waste into at least two distinct streams - wet (organic fraction), and dry(fibres, plastic, metals, etc.). Each stream is stored separately in a container (typically a plastic bag or bin) which, in the case of single family residents, is then taken out to the curb for collection. The Wet/Dry theme is applicable to any material, and focuses on diverting a larger amount of organic waste from the residential waste stream for composting at a central facility.

There are two main variations of a residential Wet/Dry system: two stream (wet and dry) and three-stream (clean wet, clean dry and residue waste). In a two-stream system, no separate residue or "garbage" option is provided to the householder, as residue is pulled from the recyclable or compostable material at a materials recovery facility (MRF) or compost facility. In a three stream residential system, a separate garbage option is added.

Implementation of a comprehensive Wet/Dry system for residential waste would require construction of larger MRFs to handle an increased quantity and

array of dry recyclables. Central composting facilities would be required to process the "wet" organic fraction of the waste stream.

Implementation of a comprehensive Wet/Dry system for IC&I waste would require source separation of organics by some IC&I generators for separate collection and management. "Wet" wastes are a much smaller percentage of the IC&I waste stream (7-8% versus 30-40% for residential)

End of Pipe, Mixed Waste Processing

An end-of-pipe mixed waste processing theme involves collecting waste in an unseparated state at the point of generation, and taking it to a processing facility. Here, the recyclable fractions are removed, processed and marketed., the organic materials are composted, the combustible fraction which is not recyclable may be turned into a Refuse Derived Fuel (RFD), and the residuals are landfilled.

The mixed waste processing theme is applicable to any material in the waste stream, and may focus on diverting a larger portion of organics from the residential waste stream. It would require siting and construction of large Mixed Waste Processing facilities that would contain large unseparated waste (garbage) processing areas, sorting into dry recyclables processing streams (similar to current MRF operations), and mixed waste composting facilities. Because construction of new municipal solid waste incinerators is prohibited in Ontario, under Regulation 555 of the Environmental Protection Act (September, 1992) an RDF facility would not be considered as part of a mixed waste strategy.

Mixed waste processing of the IC&I waste stream is likely to generate a higher quality end product as most IC&I wastes are dry, therefore, contamination of recyclables with wet waste is less of any issue.

Marketability of recovered secondary materials and finished compost is a key requirement for success of a mixed waste strategy.

Product Stewardship

Product stewardship may be applied to all or a few elements of the waste stream. It would generally not focus on most organic fractions of waste (e.g. food and yard waste) and is generally applied to the dry components of the waste stream at this time.

The product stewardship theme involves product manufacturers taking responsibility for the waste management costs incurred throughout the complete life cycle of products and packaging, including those which are currently externalized. Product stewardship occurs when revenues raised are used directly for the management of the designated products/packages as waste.

Product stewardship initiatives may be either public sector or private sector based.

In public sector systems, Provincial and Municipal governments maintain an active role in the management of post-consumer products and packages as waste. Producers and distributors of consumer products contribute to the cost of the management as waste at the end of the life cycle. An industry group may also contribute finances to a publicly-operated program and collect funds using a self-imposed levy, obviating the need for a tax or similar funding mechanism.

In private sector systems, industry assumes responsibility for all aspects of the management of designated products and/or packages as waste, including system design, funding and operation . The German Green Dot System is an example of this approach.

Economic Instruments

Economic instruments include taxes, levies, grants, loans, subsidies and other financial mechanisms that alter the costs and/or benefits of alternative waste management options available to waste generators. The intended effect is to influence the decision making and behaviour of waste generators, so that they voluntarily select those options that lead to waste reduction. Economic instruments may be used to raise funds for waste reduction programs, and, in some cases, to incorporate environmental and social "externalities" into the prices of good and services. Economic instruments may include the following:

- Direct Cost Systems;
- Input Charges;
- Product Charges;
- Waste Collection/Disposal Charges;
- Deposit/Refund Systems;
- Subsidies;
- Procurement;
- Full Cost Accounting; and
- Enforcement Incentives.

Economic instruments may be applied to any element of the waste stream, although they are unlikely to focus on the organic fraction of residential waste.

Promotion/Education

This theme focuses on using promotion and education to the greatest extent possible to divert waste from disposal. Public education is used to transfer information to a particular audience. A promotion program will motivate people

to participate in a particular program, and inform the audience of a particular topic or event, such as the start of a new recycling program.

Techniques include door-to-door distribution (householder information cards, canvassing, etc.); conventional media (newspaper, TV, radio, brochures, advertisement, press conferences, etc.); community contact (block leader programs, workshops/seminars, etc.); other mechanisms (telephone hotlines, recycling surveys, etc.).

The promotion /education theme may be incorporated into any waste diversion program. Waste diversion estimates attributed specifically to promotion and education are not readily available, as these methods alone are generally used to enhance the performance of an existing waste diversion system. A strong promotion/education program is essential to the success of any waste diversion system which requires participation by householders or employees.

Generator Based Source Reduction and Reuse

This theme focuses on source reduction and reuse by waste generators which include both manufacturers and consumers of products. Source reduction includes the design, manufacture, purchase and/or use of products and materials in a way that reduces their quantity before they are disposed. Reuse focuses on using a product as many times as possible in its original form prior to recycling or discarding the product as waste.

Source reduction measures can be applied to most materials in the waste stream. They include reducing product volume and packaging (e.g. "light-weighting" packages); increasing product life and durability; purchasing products selectively and decreasing product consumption; promoting reuse (e.g. refillable packages, reuse centres); promoting practices which decrease waste generation (e.g. alternative landscaping, xeriscaping and backyard composting).

A source reduction theme can significantly reduce waste generation for some components of the waste stream. However, no source reduction program will achieve 100% participation in a large community of varying ages and cultural backgrounds.

It should be noted that none of these themes was developed directly into alternative 3Rs systems on their own. Instead, the themes were used to identify a number of elements that might be incorporated in a waste diversion system.

2.5 Step 3: Identifying the Long List of Components

A "long list" of waste diversion components was developed for screening in this study. A "long list" is made up of elements which represent a variety of waste

diversion technologies, policies, and techniques that *may be* incorporated in waste diversion systems.

The "long list" was developed from information from three major sources. The waste diversion themes identified in the previous section were used to help identify components that would be included in the "long list". The Existing and Existing/Committed systems in the GTA were analysed to identify their essential component parts. This was combined with comments provided by the public to develop a comprehensive "long list" of potential system components for further evaluation.

2.6 Step 4: Component Screening

2.6.1 Screening Criteria

The component screening for Residential and IC&I components was guided by three criteria. For a component to be retained for further consideration, each criterion had to be satisfied. The criteria are described below:

Criterion 1: A component must represent a proven technology, technique, policy and/or program
This criterion is defined to represent technologies, techniques, policies and/or programs which had the intention of diverting waste and have been successfully implemented in at least one other jurisdiction (world wide). If a component is not successfully implemented at full scale at this time but was considered to have potential for successful implementation in the future, the component was retained as a "secondary enhancement long term component" (described below).

Criterion 2: A component must satisfy Government policy, regulations and standards
This criterion addresses whether a given technology, technique, policy or program is consistent with stated government policy and also meets current regulations and standards. Components requiring new legislation or amendments to existing legislation were not necessarily screened out on this basis, provided that they did not contradict existing policy.

Criterion 3: A component must reduce the quantity of waste requiring final disposal
Under this criterion, a technology, technique, policy or program must demonstrate an ability to divert a reasonable amount (which was defined generally as at least 1% for the purpose of this study) of waste from disposal. If a component was known to be beneficial (e.g. promotion/education) but measured data on diversion impacts were not available, the component was retained for inclusion in systems.

Components which met the screening criteria discussed above formed the "short list" of components which was used for Residential and IC&I system development.

2.6.2 Categorization of "Short List" Components

Waste diversion is an emerging field, and is very dynamic at this time. For this reason, a multi-level component categorization system was considered to be warranted for the component screening process. The multi-level screening process ensured that components which had future potential, but for which adequate data are not available at this time, were not eliminated from consideration.

Secondly, waste diversion systems contain many elements which can be combined in different ways to form systems. The number of permutations and combinations of components which could form systems is large. In order to limit the number of systems considered to a manageable number, the study team developed a category of essential components for system development, and a second category of optional components which can be considered as a menu of options to add to any of the systems considered.

Categorization of components enabled the study team to specify the role that each component would play in development of alternative waste diversion systems for the GTA.

Components which had satisfied the screening criteria discussed above were classified as either Core components or Enhancement Components. The purpose of each category is described below:

Core Components
Core Components consist of a technique, technology or policy that could serve as the focus of a distinguishable alternative waste diversion system. Most core components consist of a type of technology (including collecting and processing elements) around which a system can be developed. As an example, collection of dry recyclables, and processing of dry recyclables in a MRF would be core components of an Expanded Blue Box program. If a specific policy was considered likely to contribute substantially to a waste diversion system, it could also be retained as a core component. Therefore, some systems include regulatory measures or economic instruments as core components.

Enhancement Components
Enhancement components *could be* added to systems to enhance system performance and increase waste diversion. Enhancement components were further divided into primary and secondary enhancement component categories.

Only core and primary enhancement components were included in alternative waste diversion systems developed for analysis in the GTA. A description of each enhancement component category is presented below:

— **Primary Enhancement Components**
Primary Enhancement Components were used along with core components to build alternative waste diversion systems. These components (e.g. promotion and education) are proven to add an important element that would contribute to the function of a waste diversion system. The key distinction between primary and core components is that while core components can form the basis of a system, no system would be built around a primary enhancement component. In many cases, components that presently exist in GTA systems were included as primary enhancement components.

— **Secondary Enhancement Components**
Secondary Enhancement Components were components that were considered to have potential for inclusion in the different systems developed. They could be added to systems to increase waste diversion but were not considered critical to their function. Because of this, no secondary enhancement components are included in the alternative waste diversion systems developed for this study.

The Secondary Enhancement category was further divided into:

— **Immediate Secondary Enhancement Components**
These were components with immediate potential (e.g. landfill bans on leaf and yard waste, storage of recyclables, deposit systems, product stewardship) which could be added in the immediate future to enhance the performance of any of the systems considered.

— **Long Term Secondary Enhancements**
These were components that indicated potential for waste diversion (e.g. funding incentives to product manufacturers) but may not have been fully proven at this time. These were classified as long term secondary enhancement components and were retained for future consideration.

Table 2.1 summarizes the defining features of each component category.

Table 2.1

Summary of Component Categorization Process

Component Category	Defining Feature	Comments
Core Component	• Provides basis for waste diversion system development	• Provides one of defining characteristics of alternative waste management systems
Primary Enhancement Component	• Used with core components to develop complete waste diversion system	• Component lacks ability to form basis of an alternative system on its own • Components that offer less than 1% diversion but are still considered beneficial may be retained up to this level
Secondary Immediate Enhancement Component	• Components indicate immediate potential but are not crucial to function of any one system	• Components not included in any waste diversion systems developed for GTA 3Rs Analysis, but could be added to systems to enhance performance
Secondary Long-Term Enhancement Component	• Components are not proven at this time but may have potential over the long term	• Components not included in any waste diversion systems developed for GTA 3Rs Analysis
Screened Out	• Components are not currently proven • Components contradict MOEE policy • Components contribute less than 1% to waste diversion	• Components are removed from long list and receive no further analysis

This resulted in a list of 19 core and 55 primary enhancement components which were used to develop waste diversion systems for the GTA 3Rs Analysis.

2.6.3 *Results of Component Screening*

Table 2.2 presents the "long list" of components evaluated in this study and the results of the component screening process. For ease of presentation, components are presented in Table 2.2 under the following headings:

RESIDENTIAL COMPONENTS	IC&I COMPONENTS
• Reduction and Reuse (Residential and IC&I • Residential Recycling and Collection • Residential Leaf and Yard Waste Collection • Residential Household Composting • Other Residential Waste Diversion • Composting Facilities • Reuse Centres • Processing • Residential Recycling Depots/ Transfer Stations • Residential Regulation • Residential Programs • Residential Promotion /Education • Residential Economic Incentives • Residential Market Development Policies	• IC&I Hauling Recycling and Storage • IC&I Composting • IC&I Reuse • IC&I Recycling Depots/Transfer Stations • MRFs/Processing for IC&I Sector • IC&I Regulation • IC&I Programs • IC&I Promotion/Education • IC&I Economic Incentives • IC&I Market Development Policies

Table 2.3 presents an estimate of the waste diversion potential that *could be* achieved by each of the secondary enhancement components, based on available data culled from a variety of studies. For some of the secondary enhancement components, reliable data is not available at this time, due to lack of study etc. Where this is the case it has been noted. Table 2.3 provides an indication of additional diversion that *might be achieved* should these components be added to any of the alternative waste diversion systems studied in the GTA 3Rs Analysis.

Schedule A provides back-up documentation and rationale for the diversion estimates presented in Table 2.3.

TABLE 2.2

**GTA REGIONS
SCREENING OF COMPONENTS FROM THE LONG LIST**

Component #	Components	Existing or Committed in GTA Regions				Screening Criteria			Screening Conclusion					
		Durham	Peel	Metro	York	Unproven Technology or Techniques	Strategy Fails to Satisfy Government Regulations and Standards	Strategy Does Not Reduce Quantity of Waste Requiring Final Disposal	Core	Enhancement			Screened Out	Rationale
										Primary	Secondary			
											Immediate	Long Term		
RESIDENTIAL														
1.0 Reduction and Reuse (Residential and IC&I)														
1.1	Funding/distribution of source reduction equipment (backyard composters, cloth shopping bags etc)	exists to some extent in GTA Regions				proven	N/A	reduces quantity		√				Retain on basis that component reduces waste and technology is proven
1.2	Create waste reduction offices in each Region with the primary objective of promoting reduction and reuse	exists to some extent in GTA Regions				likely effective, not proven in quantitative way	N/A	likely reduces quantity over time		√				Retain on basis that offices currently exist and contribute to waste reduction
1.3	Establish community-based (i e municipal, non-profit, charitable, etc.) reuse/ repair and goods exchange centres	exists to some extent in GTA Regions				proven to divert waste from disposal	N/A	reduces quantity		√				Retain on basis that component is proven and can reduce quantity of waste disposed
1.4	Support the efforts of charitable organizations and food reuse organizations	exists to some extent in GTA Regions				proven to divert waste from disposal	N/A	reduces quantity		√				Retain on basis that charitable organizations contribute to reuse
1.5	Promotion of grass-cycling and xeriscaping	exists to some extent in GTA Regions				proven	N/A	reduces quantity		√				Retain on basis that the component contributes to reduction of grass in waste stream

1.6	Landfill ban on leaf and yard wastes, to force increased management on residential property	not in GTA at present	proven	N/A	reduces quantity			√			Retain on basis that the component is considered a valuable enhancement to any diversion system since the component contributes to diversion of leaf and yard waste
1.7	Eliminate pick-up for leaf and yard waste (Oakville has implemented ban on grass pick-up)	exists in Halton at present	proven	N/A	reduces quantity			√			Retain on basis that component encourages homeowners to manage leaf and yard waste on site and contributes to diversion of leaf and yard waste
1.8	Increase use of refillable/reusable packaging and products	carried out on voluntary basis in GTA	proven	may require government regulations	reduces quantity			√			Retain on basis that the component decreases use of disposable packaging and products, and therefore contributes to waste reduction through reuse
1.9	Landfill bans on recyclable material	exists to some extent in GTA	proven	N/A	decreases quantity disposed in GTA landfills			√			Retain on basis that the component encourages increased recycling and therefore contributes to waste diversion
1.10	Waste reduction planning requirements for construction/demolition projects	exists to some extent in GTA	likely to reduce quantities	required under new MOEE regulations	likely to increase use of secondary materials and reduce disposed waste over time			√			Retain on basis that the component encourages consideration of waste diversion in construction planning which will lead to waste diversion
1.11	Procurement ordinances (favouring durable products, recycled content, and/or reusable purchases)	exists to some extent in GTA	likely to reduce quantities	N/A	likely to increase use of secondary materials and reduce disposed waste over time			√			Retain on basis that the component promotes use of reusable and durable goods which reduces generation of waste
1.12	Local product or packaging bans	not in effect in GTA at this time	in place in state of Maine (aseptics), effects on generation of other wastes unknown (may increase waste generation)	N/A	may increase quantities disposed by causing shift to other more wasteful packaging					√	Screen on basis of uncertain and unproven waste diversion impacts

1.13	Promotion/education for school children focusing on waste reduction	in place in many/most GTA schools	proven	N/A	likely to have waste reduction impact over longer term		√				Retain on basis that this increases participation in existing waste diversion programs and will result in long term benefits (of consumer education)
1.14	Economic incentives such as Direct Cost for garbage disposal (see later section on economic incentives)	not in GTA for residential waste at this time	proven	changes to Municipal Act will provide required powers	reduces quantity	√					Retain as core component on basis that this provides strong economic incentives for waste diversion which has proven to increase waste diversion in many jurisdictions
1.15	Promotion/education program for consumers focusing on purchasing habit changes to minimize waste generation (for example bulk buying, borrowing items, buying products in recyclable packaging etc)	in GTA at this time	effect not measured, but likely to cause behaviour change over time	N/A	likely to reduce quantity			√			Retain on basis that the component promotes a change in consumption habits which results in decreased waste generation
1.16	Product redesign for increased product life and durability	uncertain of degree to which this occurs in GTA - products sold in GTA manufactured world wide	increased durability would decrease discard rate	N/A	likely reduction quantity over time				√		Retain on basis that the component results in decreased waste generation (due to longer product life) over the long term
1.17	Packaging redesign to reduce quantity and weight (light weighting)	parts and packaging sold in GTA manufactured world-wide, some packaging redesign underway by Canadian companies to comply with NAPP	will reduce packaging waste (e.g. 30% of residential wastes)	NAPP, a voluntary federal initiative, already targets packaging waste	reduces quantity				√		Retain on basis that the component results in decreased waste generation (due to reduced packaging waste) over the long term
1.18	Promote reuse (refillable packages, reuse centres)	in GTA at this time	re-use activities reduce waste going to disposal uncertain of the extent to which promotion impacts reuse	N/A	likely to reduce quantity slightly by encouraging reuse		√				Retain on basis that increased reuse leads to decreased use of disposable packages and products, thereby reducing the waste stream
1.19	Deposit/refund systems for a variety of materials	in place for some materials (beer bottles)	proven	N/A	reduces quantity			√			Retain on basis that deposit/refund systems contribute to increased recovery of materials. Provincial legislation required for implementation

1.20	Hold community source reduction workshops	not in place in GTA	proven at pilot scale (e g Maxville Kenyon)	N/A	likely to reduce quantity (amount not easily quantified)			√			Retain on basis that the component encourages source reduction behaviour
1.21	Develop "pre-cycling" campaign	not in place as major programs	impacts not proven quantitatively, likely to cause change in behaviour over time	N/A	likely to reduce quantity over time			√			Retain on basis that educating consumers results in improved source reduction behaviour and decreased waste generation
1.22	Develop award system to recognize waste reduction achievements	in place in GTA	proven (e g RCO awards)	N/A	likely to reduce quantity in directly		√				Retain on basis that the component currently exists and contributes to waste reduction
1.23	Organize SWAP days or neighbourhood garage sales	exists to limited extent in GTA	proven	N/A	minor impact		√				Retain on basis that the component currently exists and results in decreased waste generation
1.24	Develop infrastructure for distribution of high quality food from catering facilities (e.g. Second Harvest)	in place through efforts of Second Harvest	proven	may be some limitations due to liability and public health concerns	reduces quantity			√			Retain on basis that the component currently exists and provides best end use
1.25	Use food waste as animal feed	in place and used by GTA generators	proven	Ministry of Agriculture limitations on approach when feeding pigs, no limitations for other animals	reduces quantity		√				Retain on basis that the component currently exists and successfully reduces the amount of food waste disposed and results in valuable secondary use of the food
1.26	Landspread food waste	in place and used by GTA generators	proven	reviewed on a case by case basis by MOEE	reduces quantity		√				Retain on basis that the component currently exists and food waste is diverted to a useful purpose
1.27	Restrict advertising to airwaves (to minimize paper production) (Int)	not in place in GTA	unproven	unlikely that this can be implemented	if implemented, would reduce paper waste significantly					√	Although this may result in waste diversion, the component has not been proven and may constitute unfair business practices Screen on basis of unproven technique

1.28	Provide neighbourhood leaf shredders in fall	not in GTA				assume proven	N/A	would reduce quantity of disposal if leaves put to alternative uses			√			Retain on basis that the component may encourage increased diversion of leaf waste
2.0	**Residential Recycling and Collection**													
2.1	Curbside collection of Blue Box materials (bag, cart) (with expanding collection)	Y	Y	Y	Y	proven	required in forthcoming MOEE regulations	reduces quantity	√					Retain on basis that the component currently exists in GTA (and elsewhere) and has contributed to waste diversion
2.2	Curbside collection of Expanded Blue Box materials (ONP, OCC, boxboard, PET, HDPE, film and other plastics, glass, aluminum, tinplate steel, mixed paper, fine paper, textiles)	N	Y	N	N	proven	N/A	reduces quantity	√					Retain on basis that the component currently exists in GTA and has contributed to waste diversion
2.3	Collection of all dry waste in a 2-stream wet dry system	N	N	N	N	proven	conflicts with government policy	reduces quantity					√	While the component may contribute to waste diversion, this component conflicts with government policy
2.4	Collection of all dry recyclables and waste in a 3 stream wet-dry system	N	N	N	N	proven	N/A	reduces quantity	√					Retain on basis that the component has proven successful in diverting waste
2.5	Collection of all dry recyclables in a 4-stream wet dry system	N	N	N	N	proven	N/A	reduces quantity			√			Retain as immediate secondary enhancement, potential variation of 3-stream system design
2.6	Collection of recyclables at all multi-family dwellings	N	N	N	N	proven	N/A	reduces quantity		√				Retain as essential element of providing comprehensive waste diversion services to householders in GTA
2.7	Recycling services to all rural households in GTA (depot, curbside)	N	N	N	N	proven	N/A	reduces quantity		√				Retain on basis that the component would increase diversion
2.8	Drop-off depot system for dry recyclables and other (e.g. bulky) materials	Y	Y	Y	Y	proven	N/A	reduces quantity		√				Retain on basis that the component would provide increased opportunities for diversion
2.9	Collection of dry recyclables in a mixed waste collection system	N	N	N	N	limited success	conflicts with forthcoming MOEE regulations	reduces quantity					√	Screen on basis that component conflicts with government policy for source separation

2.10	Curbside collection of wet household kitchen waste	N	N	N	N	proven at pilot scale	N/A	reduces quantity		√				Retain on basis that the component contributes to diversion of wet wastes not handled by existing recycling systems
2.11	Curbside collection of household organics in a 2-stream wet/dry collection system	N	N	N	N	proven at pilot scale	conflicts with Government policy	reduces quantity					√	Screen on basis that a 2 stream collection system conflicts with government policy
2.12	Curbside collection of household organics in a 3-stream wet/dry collection system	N	N	N	N	proven at pilot scale	N/A	reduces quantity	√					Retain on basis that the component contributes to increased waste diversion
2.13	Curbside collection of household organics in a 4 stream wet/dry collection system	N	N	N	N	proven at pilot scale	N/A	reduces quantity			√			Retain as immediate secondary enhancement of 3-stream system design
2.14	Special/separate collections at curbside	Y	Y	Y	Y	proven	N/A	reduces quantity		√				Retain on basis that the component provides opportunities to divert waste conveniently
2.15	Collection of dry recyclables from multi-family buildings containing 6 or more units	Y	Y	Y	Y	proven	complies with proposed 3Rs Regulations	reduces quantity		√				Retain on basis that the component contributes to increased waste diversion
2.16	Collection of 3rd bag of waste for further processing	N	N	N	N	proven	N/A	reduces quantity	√					Retain on basis that the component contributes to increased capture and diversion of recyclable materials resulting in decreased waste disposal
3.0	**Residential Leaf and Yard Waste Collection**														
3.1	Seasonal curbside collection of leaf and yard waste	Y	Y	Y	Y	proven	meet 3Rs Regulations	reduces quantity		√				Retain on basis that the component provides opportunities to divert leaf and yard waste conveniently
3.2	Drop-off depots for leaf and yard wastes	Y	Y	Y	Y	proven	meet 3Rs Regulations	reduces quantity		√				Retain on basis that the component provides opportunities to divert leaf and yard waste

4.0 Residential Household Composting														
4.1	Distribution/provision of backyard composters (at specified levels) for backyard composting by single family residents	Y	Y	Y	Y	proven	N/A	reduces quantity		√				Retain on basis that the component provides opportunities to divert residential organics resulting in increased waste diversion
4.2	Backyard composting (large 3 bin units) for multi-family residents	N	N	Y	N	proven	N/A	reduces quantity		√				Retain on basis that the component provides additional opportunity to divert residential organics resulting in increased waste diversion
4.3	Vermicomposting by multi-family residents	Y	Y	Y	Y	proven	N/A	reduces quantity		√				Retain on basis that the component provides additional opportunity to divert residential organics resulting in increased waste diversion
5.0 Other Residential Waste Diversion														
5.1	Household hazardous waste (including mobile HHW depots)	Y	Y	Y	Y	proven	N/A	reduces quantity		√				Retain on basis that the component provides an opportunity to divert an additional element of the waste stream resulting in increased waste diversion
5.2	Toxic taxi	N	Y	Y	Y	proven	N/A	reduces quantity		√				Retain on basis that the component provides a convenient opportunity to divert an additional element of the waste stream resulting in increased waste diversion
5.3	White goods collection and drop-off	Y	Y	Y	Y	proven	N/A	reduces quantity		√				Retain on basis that the component provides a convenient opportunity to divert additional elements of the waste stream resulting in increased waste diversion

5.4	Special/separate collections at curbside for bulky waste (white goods, furniture, Christmas trees, etc)	Y	Y	Y	Y	proven	N/A	reduces quantity		√				Retain on basis that the component provides a convenient opportunity to divert additional elements of the waste stream resulting in increased waste diversion
6.0 Composting Facilities														
6.1	Centralized windrow composting of source separated organics	N	N	N	N	proven	N/A	reduces quantity			√			Retain as secondary immediate component on basis that the component results in increased waste diversion but may experience odour problems
6.2	Centralized windrow composting of mixed waste (third bag)	N	N	N	N	unproven	compost quality fails current standards and causes odour problems	reduces quantity					√	Screen on basis that technology is unproven and may cause odour problems
6.3	Centralized windrow composting of mixed waste	N	N	N	N	technology experiences ongoing problems	conflicts with proposed MOEE regulations	reduces quantity					√	Screen on basis that component conflicts with proposed MOEE 3Rs Regulations
6.4	Centralized in-vessel composting of source separated organics	N	N	Y	N	proven	N/A	reduces quantity	√					Retain on basis that the component is an appropriate processing technology for and an essential element of a 3 stream collection system
6.5	Centralized in-vessel composting of mixed waste (third bag)	N	N	N	N	proven	N/A	reduces quantity	√					Retain on basis that the component is a required processing technology for third bag, to increase diversion
6.6	Centralized in-vessel composting of mixed waste	N	N	N	N	technology experiences ongoing problems	conflicts with proposed MOEE regulations	reduces quantity					√	Although this technology may result in waste diversion, screen on basis of conflict with proposed MOEE 3Rs Regulations
6.7	Community composting/gardening projects	in GTA				proven	compost can be used locally	reduces quantity		√				Retain on basis that the component contributes to increased awareness of composting and results in waste diversion

6.8	Centralized windrow composting of leaf and yard waste	in GTA				proven	compost can be used locally	reduces quantity	√					Retain as core component on basis that the component processes diverted leaf and yard waste
6.9	Use centralized anaerobic digesters	N	N	N	N	proven in Europe	N/A	reduces quantity			√			Retain as secondary immediate component as potential substitute for aerobic composting
7.0 Reuse Centres														
7.1	Social Service Centres (i e Goodwill)	Y	Y	Y	Y	proven	N/A	reduces quantity		√				Retain on the basis that components exist and contribute to waste reduction through reuse
8.0 Processing														
8.1	Processing of source separated or commingled dry recyclables in material recovery facility (MRF) (improved or expanded as required)	Y	Y	Y	Y	proven	N/A	reduces quantity	√					Retain as a core component as the component is proven technology for processing dry recyclables
8.2	Processing of mixed wet and dry waste in a Mixed Waste Processing Facility	N	N	N	N	proven	conflicts with government policy	reduces quantity					√	Screen on basis of conflict with government policy
8.3	Processing third bag waste in a mixed waste facility	N	N	N	N	proven	N/A	reduces quantity	√					Retain as core component as the component is a required processing technology for "third bag" of waste
8.4	Processing of single material streams (e.g wood, tires etc) in custom designed facilities	Y	Y	Y	Y	proven	N/A	reduces quantity		√				Retain as processing component that contributes to waste diversion
8.5	Replace collection and processing equipment and approach with world-wide state-of-the-art technology (from Japan, Germany, etc.)	GTA systems use state-of-the-art technology when upgrading				being proven on an on-going basis	N/A	some techniques will increase waste diversion				√		Retain as secondary long-term component on basis that new technologies may be developed to increase waste diversion
8.6	Use sophisticated sorting facilities which feed pyrolysis or gasification plants	does not exist in GTA				proven	conflicts with government policy in some cases	reduces quantity					√	Screen on basis that incineration is contrary to provincial legislation

9.0	**Residential Recycling Depots/Transfer Stations**										
9.1	Provide adequate depots for all neighbourhoods in GTA to complement existing Blue Box system (located at transfer stations, landfill sites, etc.)	Y Y Y Y	proven	N/A	reduces quantity		√				Retain on basis that the component provides an increased opportunity for waste diversion
9.2	Drop-off depot system for dry recyclables and other (e.g. bulky) materials	Y Y Y Y	proven	N/A	reduces quantity		√				Retain on basis that the component provides an increased opportunity for waste diversion
9.3	Drop-off depots for all household organics (food, other wet wastes and garden wastes)	N N N N	proven	N/A	reduces quantity		√				Retain on basis that the component provides an increased opportunity for organic waste diversion
10.0	**Residential Regulation**										
10.1	Develop requirement that all waste received at landfill must be from designated processing facilities (no unprocessed waste to landfill)	N N N N	proven	N/A	reduces quantity			√			Retain as secondary immediate enhancement as potential method of increasing residential waste diversion
10.2	Mandatory source separation (3Rs) by residential sector	exists in Halton	proven	N/A	strategy increases waste diversion			√			Retain as potential method of increasing participation in source separation programs
10.3	Landfill bans on a variety of materials	Y Y Y Y	proven in GTA	N/A	reduces quantity for disposal		√				Retain on basis that the component encourages increased recycling and therefore contributes to waste diversion
10.4	Flow control (delivery of residential waste to designated facilities)	does not exist in GTA	implementation being overturned in U.S.	conflicts with government policy	does not necessarily reduce quantity					√	Screen on basis of conflict with government policy
10.5	Require municipalities in GTA to achieve designated diversion targets	not currently enforced at municipal level	proven	N/A	may assist in reducing quantity			√			Retain as immediate secondary component on basis that mandatory targets increase diversion
10.6	Require municipalities in GTA to establish effective waste generation and diversion monitoring systems	in place for residential but not IC&I sector	proven	N/A	may assist in reducing quantity			√			Retain as immediate secondary component on basis that good feedback increases system performance
10.7	Ban non recyclable packaging products	not currently enforced at municipal level	effects not proven or quantified	N/A	may assist in reducing quantity					√	Screen on basis of unproven results of policy

10.8	Change compost quality standards to allow more widespread use of compost	provincial jurisdiction				unproven	inconsistent with stated government policy	strategy likely to reduce quantity of waste requiring landfill					√	Screen on basis of inconsistency with government policy
11.0	**Residential Programs**													
11.1	Reduce garbage collection frequency	Y	Y	Y	Y	proven	N/A	likely decreases quantity		√				Retain on basis that the component currently exists and is likely to increase waste diversion
11.2	Set-out limit (bag limit) for garbage collection	N	N	N	Y	proven	N/A	likely decreases quantity		√				Retain on basis that the component currently exists and may increase waste diversion
11.3	Reduce frequency of recyclables collection	Y	N	Y	N	proven	frequency at half of garbage collection frequency meets 3Rs Regulations	does not increase waste diversion					√	Screen on basis of failure to reduce waste requiring final disposal
11.4	Allow residences to refuse delivery of unwanted "junk mail"	on voluntary basis in GTA				not quantified	N/A	may reduce disposal			√			Retain on basis of potential source reduction of junk mail
11.5	Reject loads with visible designated materials	Y	Y	Y	Y	proven	N/A	would reduce disposed waste			√			Retain on basis that the component reduces disposal of recyclable materials
11.6	Develop landfill management practices which utilize disposed waste as cover material	N	N	N	N	proven	N/A	strategy preserves landfill capacity			√			Retain on basis that component "reuses" waste materials as a resource
11.7	Produce compost on-site for landfill cover and preserve capacity	N	N	N	N	proven	N/A	strategy preserves landfill capacity			√			Retain on basis that component displaces borrow material as daily cover in landfill
11.8	Volume based disposal fees	N	N	N	N	proven	N/A	may reduce quantities received			√			Retain on basis that the component encourages increased diversion of low density materials
11.9	Disposal surcharges on some items (e g tires, white goods etc)	Y	Y	Y	Y	proven	N/A	may reduce quantities received		√				Retain on basis that component exists and provides an economic incentive to increased waste diversion

11.10	Landfill mining to recover materials	N	N	N	N	proven	N/A	strategy preserves landfill capacity but does not directly reduce quantity of waste requiring disposal					√	Screen on basis that the component does not meet third criterion, however strategy is of value to preserve landfill capacity
11.11	Establish scavenging centres at all landfills	N	N	N	N	proven	may contravene local by-laws	quantity of recoverable material may be very small					√	Screen on basis of potential conflict with local by-laws, local by-laws that prevent scavenging should be reviewed
11.12	Differential tipping fees based on degree of processing or waste composition	Y	Y	Y	Y	proven	N/A	strategy encourages processing and increases quantity diverted		√				Retain on basis that component exists and contributes to waste diversion
12.0	**Residential Promotion/Education**													
12.1	Expand strong 3Rs educational programs at all educational institutions (schools, universities, colleges etc.)	Y	Y	Y	Y	proven	N/A	reduces quantity but difficult to measure extent		√				Retain on basis that component encourages participation leading to increased waste diversion (now and in the future)
12.2	Develop strong consumer education program to encourage bulk buying, refuse excess packaging, promote re use, buy recycled, promote refillable containers etc	Y	Y	Y	Y	proven	N/A	reduces quantity but difficult to measure extent		√				Retain on basis that component exists and contributes to source reduction and waste diversion
12.3	Develop strong homeowner education program to focus on pre-cycling, backyard composting, grass-cycling, Direct Cost, Expanded Blue Box, Wet/Dry, reuse, etc.	Y	Y	Y	Y	proven	N/A	reduces quantity but difficult to measure extent		√				Retain on basis that component contributes to behaviour change and increased waste diversion
12.4	Support community based educational program such as neighbourhood composting (e.g. Port Colborne)	Y	Y	Y	Y	proven	N/A	reduces quantity but difficult to measure extent		√				Retain on basis that component encourages community activity, increases interest, awareness and participation in waste diversion activities

13.0	**Residential Economic Incentives**										
13.1	Direct Cost system for garbage collection at curbside	Direct Cost not in place	proven	N/A	reduces quantity	√					Retain on basis that component provides visible economic incentive to increased waste diversion
13.2	Financial incentives to purchase durable products	not in place	unproven	N/A	difficult to design and administer programs to achieve waste reduction Difficult to monitor waste reduction that is achieved due to these policies specifically					√	Screen on basis that strategy is unproven because ability of this type of policy to achieve waste reduction is not known and if implemented it would be difficult to monitor results achieved
13.3	Grant programs to support source reduction in residential sector	in place	proven, but hard to measure	N/A	assumed to reduce quantity			√			Retain on basis of assumed waste diversion potential
13.4	Full cost accounting forcing municipalities to charge the full or total cost of waste management	in place in GTA	proven	N/A	reduces quantity			√			Retain on basis that charging full costs of waste management would provide increased incentive to waste diversion
14.0	**Residential Market Development Policies**										
14.1	Integrate waste diversion with economic development programs to create markets for secondary materials	not in place	under consideration in many jurisdictions	N/A	over long term, policy would stimulate secondary materials markets locally				√		Retain as long term secondary component on basis that component appears to have potential to reduce waste, although specific impact on GTA waste diversion is uncertain
14.2	Mandate product stewardship with requirement for market development	not in place	proven in Germany	consistent with government policy	increases recovery thereby reduces quantity of waste to disposal			√			Retain on basis that component reduces waste to final disposal

IC&I											
15.0	IC&I Hauling, Recycling and Storage										
15.1	Expand Blue Box system to cover all IC&I facilities who want to participate, with focus on institutional and commercial	N Y Y N	proven	N/A	reduces quantity			√			Retain on basis that component would provide increase diversion by providing increased opportunities to recycle
15.2	Provision of bins at major IC&I facilities (e g hospitals, schools, shopping malls, etc)	not provided in comprehensive manner	proven	N/A	likely to decrease quantity			√			Retain on basis that recovery would increase through convenient opportunities to recycle
15.3	Collection of source separated dry recyclables	in place	proven	N/A	likely to decrease quantity	√					Retain on basis that component exists and contributes to waste diversion
15.4	Collection of commingled dry recyclables from IC&I sector	in place	proven	N/A	likely to decrease quantity	√					Retain on basis that component exists and contributes to waste diversion
15.5	Collection of source separated organics from IC&I sector	in place	proven	N/A	likely to decrease quantity	√					Retain on basis that component exists and contributes to waste diversion
15.6	Collection of mixed waste from IC&I sector	in place	proven	N/A	reduces quantity disposed if subsequently processed and marketed		√				Retain on basis that it material is processed, contributes to waste diversion
15.7	Long term storage of dry IC&I recyclables until recycling technologies developed and/or profitable/stable markets developed	does not exist in GTA	unproven	no apparent conflict with government policy	impact on diversion uncertain					√	Screen on basis of unproven technology
15.8	Short term (3 to 6 month) storage of IC&I dry materials to take advantage of emerging recycling technologies and/or market prices	likely to exist informally in GTA	N/A	no apparent conflict with government policy	could reduce quantity of waste disposed			√			Assuming stringent storage conditions met, may ensure successful diversion of large quantities of materials

16.0	**IC&I Composting**										
16.1	On-site composting of IC&I organics (vermicomposters and other by restaurants, schools, grocery stores, etc)	exists at some GTA facilities	proven	meeting health regulations may be difficult for many generators	reduces quantity		√				Retain on basis that component diverts waste
16.2	Centralized windrow composting of source separated organics	exists in GTA	proven, some intermittent odour problems	in some cases, odour problems occur, compost quality fails to meet MOEE guidelines for unrestricted use	reduces quantity		√				Retain on basis that component diverts organics subject to maintenance of process quality control
16.3	Centralized in-vessel composting of source separated organics	N N Y N	proven	compost quality may present limitations for end uses	reduces quantity		√				Retain on basis that component diverts organics subject to maintenance of process quality control
16.4	Centralized composting of leaf and yard waste	exists in GTA	proven	compost quality may present limitations for end uses	reduces quantity		√				Retain on basis that component diverts organics subject to maintenance of process quality control
16.5	Use centralized anaerobic digesters	exists in GTA	proven	no apparent conflict with government policy	reduces quantity			√			Retain as immediate secondary component as a technical option to aerobic composting for diversion of IC&I organics
16.6	Centralized in-vessel composting of mixed IC&I waste	does not exist in GTA	unproven, generally not applicable to IC&I waste as 93% is dry waste	conflicts with proposed MOEE regulations	slight quantity reduction					√	Screen on basis of unproven technology and conflict with proposed MOEE 3Rs Regulations
17.0	**IC & I Reuse**										
17.1	Ontario Waste Exchange	used by GTA generators	proven	N/A	reduces quantity		√				Retain on basis that component exists and has proven effective in waste diversion through reuse

18.0	**IC & I Recycling Depots/Transfer Stations**										
18.1	Provide adequate depots and transfer stations to be used by small IC&I generators, to compliment existing Blue Box system	used by GTA generators	proven	N/A	reduces quantity		√				Retain depots on basis that component provides increased opportunities to recycle
19.0	**MRFs/Processing for IC&I Sector**										
19.1	Processing of source separated or commingled dry recyclables in a material recovery facility (MRF)	in GTA	proven	N/A	reduces quantity	√					Retain on basis that component exists, and is an essential element of existing successful waste diversion programs
19.2	Processing of mixed IC&I waste in a Mixed Waste Processing facility	not in GTA	proven	does not conflict with government policy assuming IC&I generators meet source separation requirements of 3Rs Regulations	reduces quantity	√					Retain on basis that component contributes to increased diversion of (predominantly dry) IC&I waste
19.3	Processing of single material streams (e.g. tire processing facility wood, tires, etc.) in custom designed facilities	in GTA	proven	N/A	reduces quantity		√				Retain on basis that component exists and contributes to waste diversion
19.4	Construction/demolition waste processing at specialized salvaging operations	in GTA	proven	N/A	reduces quantity		√				Retain on basis that component exists and contributes to waste diversion
19.5	Replace processing equipment and approach with state-of-the-art technology world wide (from Japan, Germany, etc.) as required	has occurred as required	only proven technologies should be used	assess on case-by-case basis	likely to contribute to increased waste diversion because of increased efficiency			√			Retain on basis that this approach contributes to increased waste diversion through increased process efficiencies
19.6	Rendering of food wastes	exists in GTA	proven	N/A	reduces quantity		√				Retain on basis that component exists and contributes to food waste diversion

20 0	**IC&I Regulation**										
20.1	Develop requirement that all waste received at landfill must be from designated processing facilities (no unprocessed waste to landfill)	proven	proven	N/A	would reduce quantity to landfill by encouraging diversion of processed waste	√					Retain on basis that component is an effective method of ensuring consideration of waste diversion by IC&I sector
20.2	Mandatory source separation of various IC&I recyclables (WRAP regulations as basis) by expanding list of IC&I generators	committed system includes this requirement for some generators	proven	N/A	reduces quantity	√					Retain on basis that component exists and contributes to IC&I waste diversion
20.3	Landfill bans on a variety of materials	in place in GTA	proven	N/A	reduces quantity disposed at GTA landfills		√				Retain on basis that component exists and contributes to IC&I waste diversion
20.4	Ban non-recyclable packaging and products	not in place in GTA	unproven	needs to be implemented at provincial or federal level	impacts on disposed waste quantities not known (may increase)					√	Screen on basis of uncertain and unproven waste diversion impacts
20.5	Require retailers and/or producers to establish recovery systems for designated products and packaging	not in place in GTA	this approach used in Germany (German Green Dot) and under consideration in Canada,	N/A	likely to reduce quantity going to landfill by increasing recycling opportunities			√			Retain on basis that component contributes to IC&I waste diversion
20.6	Deposit/refund system for soft drink containers	not in place in GTA	proven	N/A	reduces quantity to landfill			√			Retain on basis that component is likely to increase recovery of specified materials and contribute to waste diversion
20.7	Deposit/refund system for all beverage containers (liquor, juice, milk, water, etc)	not in place in GTA	this system being considered (but not yet fully implemented) by a number of jurisdictions, unproven	N/A	reduces quantity to landfill					√	Screen on basis of unproven policy
20.8	Mandatory recovery rates and targets for specific materials	does not exist at this time	proven	N/A	reduces quantity			√			Retain on basis that component is likely to increase waste diversion through increased recovery

20.9	Change current health and safety regulations to allow more uses for food waste, and limit liability to encourage greater participation in food waste diversion by IC&I sector	does not exist at this time	not proven but appears to have potential	potential conflict with government policy	may increase food waste diversion and decrease quantity being disposed					√	Screen on basis that component requires amendments to existing legislation and likely conflicts with stated government regulations and standards
20.10	Change health and safety thresholds for use of secondary materials in food contact packaging or other products	under discussion provincially and federally at this time	impacts unproven, assumed to increase demand for recycled boxboard, under consideration by FDA (U.S.)	changes required to federal and provincial packaging standards, conflicts with government policy	impacts uncertain, assumed to increase demand for boxboard with recycled content, increasing market demand for fibres and therefore stimulating recycling					√	Screen on basis that component fails to meet criteria
20.11	Change compost quality standards to allow more widespread use of compost	does not exist in GTA	impacts unproven	conflicts with current government standards	strategy could significantly reduce quantity to landfill					√	Screen on basis that component conflicts with current government standards
20.12	Adopt product labelling system which promotes 3Rs	not in place, is currently implemented on voluntary basis	proven	N/A	impacts unproven					√	Screen on basis of unproven impact on waste diversion
20.13	Minimum secondary material content for packaging and products	federal labelling system in place, is currently implemented on voluntary basis	unproven	N/A	impact unproven					√	Screen on basis of unproven impacts on waste diversion
20.14	Tax industries creating excess garbage and packaging	does not exist in GTA	unproven	N/A	impact unproven					√	May stimulate markets for secondary materials however screen on basis of unproven impacts on waste diversion
20.15	Eliminate economic subsidies to industry	not in place in GTA	unproven	N/A	impact unproven					√	Screen on basis of unproven policy
20.16	Mandated levies or taxes to support 3Rs	exists to limited degree in GTA	proven	N/A	likely to increase diversion through increased financial support of 3Rs programs			√			Retain on basis that component is likely to contribute to waste diversion through increased financial support of 3Rs programs
20.17	Pass legislation against over-packaging	addressed on voluntary basis through NAPP	unproven	N/A	impact uncertain					√	Screen on basis of unproven policy

20.18	Ban use of polystyrene and similar products	does not exist in GTA	unproven	N/A	impact uncertain					√	Screen on basis of unproven policy, bans have been implemented but may result in increased waste generation (e g paper waste vs polystyrene waste)
20.19	Tax on virgin materials to develop markets for secondary materials	not in place	unproven at this time	may contravene GATT, NAFTA, and be considered a trade barrier	impacts non-specific and unknown					√	Screen on basis of unproven policy
20.20	Mandatory waste audits for IC&I generators	carried out on voluntary basis in GTA	proven to reduce waste quantities in some cases	N/A	reduces quantity		√				Retain on basis that component is an essential tool for IC&I waste diversion planning, leading to increased IC&I waste diversion
20.21	Flow control (delivery of IC&I waste to designated facilities)	does not exist in GTA	implementation being overturned in US	conflicts with government policy	does not necessarily reduce quantity					√	Screen on basis of conflict with government policy
21.0	IC&I Programs										
21.1	Change approval process to require new IC&I facilities to design for reduction and re use and submit a plan outlining these efforts prior to obtaining approval	in place in some GTA Regions	proven	N/A	likely to contribute to waste diversion in long-term			√			Retain on basis that the component encourages consideration of waste diversion in facility planning which will lead to waste diversion
21.2	Establishment of central food waste management organization to help food retailers to send excess food to food banks, or to animal feed if human consumption not viable	elements in place	not proven, but likely to be successful	there may be health and liability concerns which limit approach	if successful, waste to disposal would be reduced				√		Retain as long term secondary component on basis that if successful, would likely result in increased diversion of food waste
21.3	Allow locations to refuse delivery of unwanted "junk mail"	being practised in GTA	proven	N/A	reduces quantity				√		Retain on basis of potential source reduction of junk mail
21.4	Develop and implement a material use guideline	in progress by MOEE	proven	N/A	likely to reduce quantity			√			Retain on basis that component provides options for beneficial use of materials that might otherwise be disposed Content of guidelines will determine options for material management and impact on waste diversion

22.0	**IC&I Promotion/Education**										
22.1	Expand strong 3Rs educational programs at all educational institutions (schools, universities, colleges etc)	all GTA Regions provide IC&I education programs	limited experience exists with this type of program	N/A	likely to reduce quantity		√				Retain on basis that component increases participation in existing waste diversion programs and will result in long term benefits (of consumer education)
22.2	Develop strong IC&I generator education program	all GTA Regions provide IC&I education programs	proven	N/A	likely to reduce waste over long term		√				Retain on basis that component provides information on waste diversion and likely contributes to increased waste diversion achievements by generators
22.3	Develop environmental design program at schools and colleges	exists in GTA	proven	N/A	not proven that competent directly reduces quantity disposed					√	Screen component on basis of unproven impacts
22.4	Establish databank on waste reduction technologies and system design	exists in GTA (RCO, and other sources)	proven	N/A	may indirectly reduce quantity disposed			√			Retain on basis that easy accessibility of data supports waste diversion
23.0	**IC&I Economic Incentives**										
23.1	Financial incentives to purchase durable products	not in place	unproven	N/A	likely to have minor impacts over long term						Screen on basis that component is not proven, will probably have minor impacts and may be administratively cumbersome
23.2	Grant programs to support source reduction	supported by MOEE at this time	proven	N/A	likely to have impacts over time		√				Retain on basis that component encourages increased source reduction activities leading to waste diversion
23.3	Economic incentives to encourage product re-design for durability, recyclability and refillability	not in place	unproven	N/A	likely to have minor impacts over long term					√	Screen on basis that component is not proven, will probably have minor impacts and may be administratively cumbersome
23.4	Self-imposed levies by producers to support 3Rs	not at this time, but product stewardship models incorporate this approach	proven (German Green Dot)	N/A	would reduce quantity			√			Retain on basis that component contributes to waste diversion
23.5	Advanced disposal fee for larger wastes and special categories of waste	not in place (as of September 1993)	unproven	N/A	may have positive impact over time					√	Screen on basis that component is unproven

24.0	**IC&I Market Development Policies**										
24.1	Funding and incentives to recycling industries or other industries that utilize secondary materials	funded through MOEE	proven	N/A	direct impact on waste diversion likely to be positive			√			Retain on basis that component encourages development of markets for secondary materials
24.2	Funding incentives to product manufacturers to utilize secondary materials	exists to some extent	proven	N/A	diversion impacts not measured				√		Retain on basis that component supports development of markets for secondary materials
24.3	Provide manufacturer tax credits to end users of secondary materials	not in place at this time	unproven	N/A	impacts unknown					√	Screen on basis that component is unproven and impacts are unknown
24.4	Tax exemptions on recycling equipment	not in place at this time	unproven	N/A	may stimulate local recycling industry, but impacts on disposed quantities are uncertain					√	Screen on basis that component impacts are unknown and policy is unproven
24.5	Exempt recycled products from sales tax	not in place at in GTA	unproven, but assume that it stimulates sales of recycled products	N/A	not known if this would impact on diversion from GTA landfills (impacts not localized)					√	Screen on basis that impacts are not known (unproven)
24.6	Purchasing specifications to promote recycled content	in place by some private and public sector bodies in GTA (e.g. GIPPER)	proven	N/A	impact on GTA waste cannot be quantified			√			Retain on basis that component stimulates markets for secondary materials and contributes to waste diversion (although at this time, specific impacts on GTA waste are not measured)

TABLE 2.3

POTENTIAL DIVERSION IMPACTS OF SECONDARY ENHANCEMENT COMPONENTS

Component #	Component Description	Immediate	Long Term	Comments
1.6	Landfill ban on leaf and yard wastes, to force increased management on residential property	√		Leaf and yard waste make up 2%-11% of disposed residential waste and 2% of disposed IC&I waste in the GTA in 1992. A significant proportion of this would be diverted through a ban.
1.7	Eliminate pick-up for leaf and yard waste (Oakville has implemented ban on grass pick-up)	√		Leaf and yard waste make up 2% to 11% of the residential waste stream disposed in the GTA in 1992. A significant proportion of this would be diverted through a ban.
1.8	Increase use of refillable/reusable packaging and products	√		Should decrease packaging waste by 18% or more for overall reduction of 4.5% of waste stream. (See Schedule)
1.9	Landfill bans on recyclable material	√		Assuming existing bans divert many IC&I recyclables, the policy would target residential recyclables. Recyclable materials make up 25% of the residential stream disposed. Assuming 70% of remaining recyclables were diverted through the ban; 17.5% diversion increment of residential stream would be achieved
1.10	Waste reduction planning requirements for construction/demolition projects	√		Would reduce C&D waste generation by at least 10%, with long term waste diversion benefits.

1.11	Procurement ordinances (favouring durable products, recycled content, and/or reusable purchases)	√		Strengthens markets for secondary materials and reusable containers. Impacts on diversion difficult to quantify.
1.15	Promotion/education program for consumers focusing on purchasing habit changes to minimize waste generation (for example bulk buying, borrowing items, buying products in recyclable packaging etc.)	√		Effect not measured but likely to cause behaviour change over time, resulting in source reduction.
1.16	Product redesign for increased product life and durability		√	Increased durability would decrease discard rate, thus increasing diversion through source reduction. Measure would apply mostly to durable goods (4-8% of disposed residential waste stream).
1.17	Packaging redesign to reduce quantity and weight		√	Would result in slight decrease in packaging waste (assume 1.5% diversion increment).
1.19	Deposit/refund systems for a variety of materials	√		Ensures high recovery (over 90%) of materials involved. If applied to all glass, metal and plastic food and beverage containers (8-10% of the residential waste stream), incremental diversion would be 1.6-2% of residential waste stream.
1.20	Hold community source reduction workshops	√		Likely to reduce quantity of waste generated through increased awareness of source reduction (impact is not easily measured).
1.21	Develop "pre-cycling" campaign	√		Likely to cause behaviour change over time resulting in source reduction (3% measured in Colorado).

1.24	Develop infrastructure for distribution of high quality food from catering facilities (e.g. Second Harvest)		√	Applicable to IC&I sector food waste. Potential to divert some (assume 10%) of 7% of IC&I sector waste which is food, i.e. 0.4% diversion of total waste stream.
1.28	Provide neighbourhood leaf shredders in fall	√		Assists in composting of leaf wastes. Contributes to diversion of 0.2 to 1.4% of residential waste stream (2-11% leaf and yard waste, 25% of which is leaf waste. Assume 50% of this fraction.)
2.5	Collection of all dry recyclables in a 4-stream wet-dry system	√		Diversion impacts likely similar to 3-stream (around 60% of residential waste).
2.13	Curbside collection of household organics in a 4-stream wet-dry collection system	√		Diversion impacts likely similar to 3-stream (around 60% of residential waste).
6.1	Centralized windrow composting of source separated organics	√		Alternative processing approach for source separated organics.
6.9	Use centralized anaerobic digesters	√		Alternative processing approach for source separated organics. Could contribute to diversion of some household and IC&I organic wet wastes, which make up 30% of residential waste and 9% of the IC&I waste stream.
8.5	Replace collection and processing equipment and approach with state-of-the-art technology world wide (e.g. Japan, Germany, etc.)		√	Important design approach. Impact on diversion will depend on technique or technology being applied.
10.1	No unprocessed waste to landfill	√		Diversion should increase to over 70% for both residential and IC&I waste (see Chapter 8).
10.2	Mandatory source separation by residential sector	√		Residential diversion should increase by 20%. (Halton experience).
10.5	Require municipalities in GTA to achieve designated diversion targets	√		Diversion would likely increase .

10.6	Require municipalities in GTA to establish effective waste generation and diversion monitoring systems	√		Information could facilitate design for increased diversion.
11.4	Allow residences to refuse delivery of unwanted "junk mail"	√		Can reduce residential waste by 1.6 to 2.3% assuming reduction of 50%, and generation rate of 15kg/cap/year.
11.5	Reject loads at landfill or transfer station with visible designated recyclable materials	√		Should encourage increased source separation and diversion.
11.6	Develop landfill management practices which utilize disposed waste as cover material	√		Increases landfill life, all material put to beneficial use could save a proportion of the 20% of landfill capacity typically occupied by cover material.
11.7	Produce compost on-site for landfill cover to preserve capacity	√		Can divert quantities similar to central composting, and preserve landfill capacity.
11.8	Volume based disposal fees	√		Provides incentive to decreased disposal. Impacts depend on fees chosen.
13.3	Grant programs to support source reduction in residential sector		√	Difficult to measure diversion impacts of this type of program; impacts assumed to be positive.
13.4	Full cost accounting forcing municipalities to charge the full or total cost of waste management	√		May provide increased incentive to divert waste, if true costs of disposal are charged. Disposal costs of $80 to $90/tonne charged in GTA are likely close to full cost, therefore the effect of this policy may be minimal.
14.1	Integrate waste diversion with economic development programs to create markets for secondary materials	√		Development of local markets beneficial, by creating stable demand. Difficult to measure diversion impacts of this type of program; impacts assumed to be positive.

14.2	Mandate product stewardship with requirement for market development	√		Could result in recovery of 80% of packaging (25% of residential waste), some of which is currently diverted.
15.1	Expand Blue Box system to cover all IC&I facilities who want to participate, with focus on institutional and commercial	√		Should increase diversion by providing convenient opportunity for IC&I sector to recycle.
15.2	Provision of bins at major IC&I facilities (e.g. hospitals, schools, shopping malls, etc.)	√		Would increase diversion by providing additional opportunities to recycle.
15.8	Short term (3 to 6 month) storage of IC&I dry materials to take advantage of emerging technologies and/or market prices	√		Contributes to diversion by providing protection against short term market problems. Impacts depend on materials involved.
16.5	Use centralized anaerobic digesters	√		Alternative processing approach for source separated organics. Can contribute to diversion of 30% of residential waste and 9% of IC&I waste which is organic.
19.5	Replace collection and processing equipment and approach with state-of-the-art technology world wide (e.g. Japan, Germany, etc.) (same as 8.5)	√		Important design approach. Impact on diversion will depend on technique or technology being applied.
20.5	Require retailers and/or producers to establish recovery systems for designated products and packaging	√		Similar to Green Dot approach. Would contribute to diversion of 25% of residential waste.
20.6	Deposit/refund system for soft drink containers	√		Ensures high recovery, diversion of materials involved. If applied to beverage containers (2% of the residential waste stream) incremental diversion would be 0.4% of residential waste stream
20.8	Mandatory recovery rates and targets for specific materials	√		Increases waste diversion. Rate depends on material.

20.16	Mandated levies or taxes to support 3Rs	√		Provides source of funds to support 3Rs and therefore contributes to diversion. Impacts on waste diversion can be quantified when details of system scoped out.
21.1	Change approval process to require new IC&I facilities to design for reduction and re-use and submit a plan outlining these efforts prior to obtaining approval	√		Will have waste diversion impacts in longer term (impacts can not be quantified until details of policy scoped out).
21.2	Establishment of central food waste management organization to help food retailers to send excess food to food banks, or to animal feed if human consumption not viable		√	Can contribute to diversion of some IC&I food waste (7% of IC&I waste stream). Some portion of this could be diverted for human and animal consumption (% of food waste stream suitable for this purpose is not known).
21.3	Allow locations to refuse delivery of unwanted "junk mail"		√	Would increase diversion. Percentage of IC&I waste which is junk mail is not known.
21.4	Develop and implement a material use guideline.	√		May strengthen markets/ uses for waste materials.
22.4	Establish databank on waste reduction technologies and system design	√		Will benefit waste diversion by providing easy access to information. Direct impacts on waste diversion can not be quantified.
23.4	Self-imposed levies by producers to promote 3Rs	√		Similar impacts to German Green Dot program.
24.1	Funding and incentives to recycling industries and other industries that utilize secondary materials	√		Would stabilize markets for secondary materials, contributing to sustainability of 3Rs systems.
24.2	Funding incentives to product manufacturers to utilize secondary materials		√	Would stabilize markets for secondary materials, contributing to sustainability of 3R's systems.

24.6	Purchasing specifications to promote recycled content		√	Would stabilize markets for secondary materials, contributing to sustainability of 3R's systems. Direct impacts on waste diversion can not be quantified.

2.7 Step 5: Development of Potential Alternative Residential Waste Diversion Systems for the GTA.

A set of six representative residential waste diversion systems was developed from the short list of core and primary enhancement components. The systems presented in this study do not span the full range of potential waste diversion systems that could be considered, and development of these particular systems does not imply a preference on the part of the authors.

This group of potential alternative systems was assembled as a *combination of waste diversion components* which could be added to the Existing or Existing/Committed waste diversion system in each region, to further reduce the amount of waste which is currently disposed. The systems provided a basis from which to examine the potential for different approaches to waste diversion in GTA municipalities, but do not present a complete list of possible permutations and combinations of waste diversion system components to optimize diversion.

The Existing System was adopted as the "do-nothing" alternative. Any commitments made for waste diversion, at all levels of government, and by the private sector were incorporated into the Existing/Committed System for each region. In addition to these two systems, four additional residential waste diversion systems were developed. These systems present an array of distinctly different technological and/or policy-driven approaches to residential waste diversion. Components which were identified as "core" in Table 2.2 were combined with those identified as "primary enhancement components" to form four additional residential waste diversion systems, which were:

- a "Direct Cost" system;
- an "Expanded Blue Box" system;
- a "Wet/Dry" system; and
- a "Mixed Waste Processing" system.

A brief description of the six residential waste diversion systems analysed is presented below:

Residential System 1 - Existing - the "do nothing" alternative is based on the status quo, i.e. the residential waste diversion system which was in place in each GTA Regional municipality on 31 December, 1992;

Residential System 2 - Existing/Committed - policies announced by 31 December, 1992 (including 3Rs Regulations) and waste diversion programs committed in 1992 Regional five-year budgets (to the end of 1997);

Residential System 3 - Direct Cost - an alternative built on the Existing/Committed System which includes a user fee (charged to the homeowner) for garbage collection;

Residential System 4 - Expanded Blue Box - a system where the range of dry recyclables collected at the curb are expanded and household organics (food and yard waste) is managed through backyard composters and separate collections of leaf and yard waste;

Residential System 5 - Wet/Dry - Household waste is collected in three streams including wet food and yard wastes, dry recyclables, and garbage, with central composting of wet wastes;

Residential System 6 - Mixed Waste Processing - a system which includes Blue Box collection of recyclables, separate collection of leaf and yard waste, backyard composting of some household wet wastes and processing of the remaining "third bag" of waste in a mixed waste processing and composting plant.

More detailed descriptions of each system are presented in Chapter 4.

2.8 Step 6: Developing Potential Alternative IC&I Waste Diversion Systems for the GTA

A set of six representative waste diversion systems was developed for the IC&I sector from the short list of core and primary enhancement components. As with the residential systems, a group of potential alternative systems was assembled as a *combination of waste diversion components* which could be added to the Existing or Existing/Committed IC&I waste diversion systems to reduce the amount of waste which requires disposal. The systems provided an analytical basis from which to examine the potential for different approaches to divert IC&I waste in GTA municipalities, but do not present a complete list of possible combinations of waste diversion system components to optimize diversion.

The Existing System was based on the system in place in the GTA at the end of 1992. It was adopted as the "do-nothing" alternative. Any policy and program commitments made for waste diversion, at all levels of government, and by the private sector were incorporated into the Existing/Committed System. This includes short term (e.g. 1993 - 1997) commitments which incorporate the impacts of the Provincial 3Rs Regulations and NAPP.

In addition to these two systems, four additional alternative systems were developed. Because waste management in the IC&I sector is predominantly conducted on a private basis, a regulatory approach, which can cover all IC&I generators is a comprehensive method by which diversion can be increased. For this reason, the IC&I systems are primarily policy-driven and focus on regulatory measures which could be implemented to increase the quantities of IC&I waste diverted.

Again, components which were identified as "core" in Table 2.2 were combined with those identified as "primary enhancement components". Together, these combined to form four alternative IC&I waste diversion systems, which were:

- an "Extended 3Rs" Regulations system;
- an "Expanded 3Rs" Regulations system;
- an "Expanded 3Rs Regulations with Organics" system; and
- a "No Unprocessed Waste to Landfill" system.

A brief description of the six IC&I waste diversion systems analysed is presented below:

IC&I System 1 - Existing - the "do nothing" alternative is based on the IC&I waste diversion system that was in place in the GTA as of 31 December, 1992.

IC&I System 2 - Existing/Committed - policies announced as of 31 December, 1992, including the 3Rs Regulations which require that designated sectors conduct waste audits, packaging audits, develop waste and packaging reduction plans and implement source separation programs for specified materials, and including the National Packaging Protocol (NAPP).

IC&I System 3 - Extended 3Rs Regulations - a system built on System 2 that applies 3Rs Regulations to a much greater number of IC&I generators. The system is generally referred as Extended 3Rs.

IC&I System 4 - Expanded 3Rs Regulations - a system that builds on System 3, and mandates source separation of a wider range of dry materials by the same group and number of IC&I generators identified in System 3. The system is generally referred to as Expanded 3Rs.

IC&I System 5 - Expanded 3Rs Regulations with Organics - a system that builds on System 4, and requires designated IC&I generators to source separate and divert wet wastes (food waste, leaf and yard wastes). The system is generally referred to as Expanded 3Rs with Organics.

IC&I System 6 - No Unprocessed Waste to Landfill - a system that builds on System 2 and would require that all material disposed as waste be processed (through any legitimate means) prior to landfilling.

A more detailed description of these systems is presented in Chapter 6.

2.9 Impact Assessment Criteria

Once the range of systems had been identified, the Service discipline undertook its analysis of the systems.

The six residential and IC&I systems were analysed according to four criteria under the Service discipline. These included reliability, flexibility, performance and social acceptability.

Table 2.4 presents the indicators used for each of these four criteria groups, along with a definition of the indicators, and a rationale for choosing the indicators.

This document presents technical data on which the reliability, flexibility and performance of various system components were evaluated. The social acceptability data are presented in the Social Environment Technical Appendix (Hardy Stevenson and Associates, 1993).

2.10 Data Sources

All systems analysis is based on the best available information. To gather information related to each criteria group for the residential systems, the study team contacted representatives of each municipality to gather information related to performance of existing waste diversion systems and the committed systems. Leading edge waste diversion programs from across North America (and Europe) were either contacted or studied using available published and unpublished reports in order to gain information related to each of the criteria groups.

For the IC&I systems, information about waste disposal and diversion figures were obtained through several sources, as described in Section 6 of this Appendix. Private sector haulers, municipal representatives and large businesses were contacted. Where applicable, recent studies of waste disposal, diversion and composition in the IC&I sector were utilized in order to adequately quantify the flow of IC&I waste in the GTA. This was matched with

employment data and employment projections for each region on a sector by sector basis. From this, estimates of waste diversion were made, per material, and used to estimate total waste diversion from the IC&I sector in the GTA.

2.11 Assumptions

In order to apply the data gained from the many studies that were utilized, several assumptions were made by the study team. The assumptions applied in the development and analysis of the Residential Systems are detailed in Section 4.3. Section 6 identifies assumptions made in development of waste generation, composition and diversion used in development of the Existing and potential IC&I systems.

2.12 Methods of Analysis

Each of six residential and six IC&I potential waste diversion systems were studied in a "Net Effects Analysis" process. This involved a systematic analysis of each component of each system according to the criteria groups and the indicators detailed above. Residential systems were analysed on a region by region basis while the IC&I systems were analysed at the GTA-wide level. A technical ranking for the Service Criteria Group, from highest to lowest, was provided for each system, by region for the residential systems, and for the GTA as a whole for the IC&I systems.

2.13 Definition of Waste

The definition of waste used in this analysis is taken from Regulation 347 (RSO 1990, printed June 1993) and is as follows:

"**municipal waste**" means,

a. any waste whether or not it is owned, controlled or managed by a municipality, except,

    i. hazardous waste,
    ii. liquid industrial waste, or
    iii. gaseous waste, and

b. solid fuel, whether or not it is waste, that is derived in whole or in part from the waste included in clause (a); O. Reg. 555/92, s. 1.

3.0 RESIDENTIAL WASTE GENERATION AND COMPOSITION ESTIMATES

3.1 General

There are a number of methods by which waste generation projections can be estimated. Total waste generation in GTA has been divided into residential and IC&I waste generation for this analysis. This study has assumed that waste generation will remain at a constant level (in terms of generated tonnes/employee for IC&I waste, and tonnes/ capita for residential waste. Source reduction, which will result in a decrease to the constant generation rate is estimated separately, and subtracted from the generation estimates.

Historical waste generation data, population projections, and residential waste generation estimates for each GTA Region are presented in this chapter. This is followed by a discussion of available residential waste composition data, and estimates of the composition of residential waste generated and disposed in each GTA Region in 1992. Generation and composition for the IC&I sector are presented in Chapter 4 of this volume.

3.2 Residential Waste Generation Estimates and Projections

3.2.1 Introduction

This section presents residential waste quantity estimates and projections for the five regions in the GTA for the years 1993 to 2015. An analysis of available historical residential waste generation, diversion and disposal data for each region was conducted to determine the residential waste generation rates upon which the residential waste quantity projections are based. Quantities diverted included tonnes of dry materials reported to be diverted through curbside Blue Box and depot programs, materials collected through leaf and yard waste collection programs, and miscellaneous other residential waste diversion programs such as white goods collection, etc. Materials collected through various wet-dry pilot projects were also considered, when data were available. The number of backyard composters in each region was multiplied by an assumed diversion rate per year to estimate the diversion through backyard composters.

In the case of residential waste, it has been assumed that there was minimal, if any, export, and that the quantities disposed at landfill, added to estimates by regional staff of residential waste quantities diverted, provide a reasonably accurate estimate of residential waste generation for each of the years 1986 to 1992.

3.2.2 Population Data and Forecasts

Historical population data for each GTA Region for 1986 - 1992 were obtained from Hardy Stevenson and Associates (Hardy Stevenson and Associates, 1993). The 1986 and 1991 data were obtained from 1986 and 1991 Statistics Canada Census data, and the data for the non-census years were obtained from the regional planning departments.

Population projections for 1993 - 2015 (Hardy Stevenson, 1993) are presented in Table 3.1. The data sources upon which these are based include Clayton Research Associates Ltd., Hemson Consultants Limited, the Office of the Greater Toronto Area, Interim Waste Authority, and information from regional municipalities.

The number of households, by dwelling type and region, are presented in Table 3.2. Households are categorized as single-detached, high-rise apartment, and other (which includes low-rise, townhouses, duplexes etc.). The values presented in the table were prepared based on 1991 Census data, and projections provided by Clayton Consultants Ltd., and the regional planning departments.

3.2.3 Residential Waste Generation Estimates for Region of Durham

Durham Waste Disposal Data

Over 98% of Durham Region's waste is disposed of in Metro's Brock West landfill. There are two regionally owned landfill sites, Brock and Scott, which are currently operational. These handle less than 2 percent of Durham's solid waste. It is anticipated that the Scott landfill will reach capacity in 1994. The Brock site accepts waste only from Brock Township, and will close in approximately six years (Lombardo, Durham Works Dept., 1993). The Study Team obtained data for waste generated in Durham Region and disposed at the Brock West and Keele Valley landfills for the years 1986 through 1992 from Metro Toronto, and for 1987 through 1992 from Durham Regional staff. Tonnages for the smaller regional landfills were obtained from Durham Works Department.

The quantities of total Durham waste disposed at landfill as reported by Metro were somewhat higher than those reported by Durham Region. This difference is reportedly due to Durham waste being disposed at landfill by haulers who are not on Durham's approved list of haulers (Todd, M.M. Dillon Ltd., 1993). Apparently Metro keeps track of all of the waste passing over the weigh scales at their landfills, including the waste generated by Durham sources and disposed at Metro's landfill by haulers who are not on Durham's approved list. Durham Regional staff only keep track of the waste

Table 3.1

Population Projections for GTA by Region

Year	Metro Toronto	Durham	Halton	Peel	York
1991	2,275,800	409,075	313,136	744,700	504,981
1992	2,298,031	422,825	318,893	763,000	522,248
1993	2,320,480	438,380	324,756	784,500	540,106
1994	2,343,148	453,880	330,727	808,800	558,575
1995	2,366,037	469,335	336,807	833,500	577,675
1996	2,389,150	484,745	343,000	859,300	597,459
1997	2,404,140	500,120	351,538	879,500	615,017
1998	2,419,130	515,450	360,290	900,700	632,605
1999	2,434,120	530,750	369,259	921,900	650,193
2000	2,449,110	546,005	378,452	953,100	667,781
2001	2,464,100	561,230	387,873	974,300	685,370
2002	2,470,430	576,425	397,529	991,100	701,325
2003	2,476,760	592,125	407,425	1,007,900	717,280
2004	2,483,090	607,790	417,568	1,024,700	733,235
2005	2,489,420	623,420	427,963	1,041,500	749,190
2006	2,495,750	639,025	438,617	1,058,100	765,143
2007	2,502,080	654,600	449,536	1,072,100	780,277
2008	2,508,410	670,160	460,727	1,086,100	795,411
2009	2,514,740	685,690	472,197	1,100,100	810,545
2010	2,521,070	701,740	483,952	1,114,100	825,679
2011	2,527,400	717,780	496,000	1,127,900	840,019
2012	2,532,890	733,770	508,347	1,139,500	853,042
2013	2,538,380	749,695	521,002	1,150,500	865,270
2014	2,543,870	765,465	533,972	1,162,000	877,498
2015	2,549,360	781,045	547,265	1,173,500	889,726

Source: Hardy Stevenson and Associates, 1993.

Table 3.2

Households by Dwelling Type, GTA Regions 1986-2011

	Single-Detached	High-rise Apartment	Other	Total
		1986		
Metro	258,403	287,736	281,353	827,492
Durham	71,070	9,255	26,330	106,655
York	84,740	5,500	14,955	105,195
Peel	86,910	42,920	56,045	185,875
Halton	58,825	13,725	17,275	89,825
Total GTA	559,948	359,136	395,958	1,315,042
		1991		
Metro	287,475	309,940	267,135	864,550
Durham	94,005	10,750	31,385	136,140
York ***	128,061	18,306	15,189	161,556
Peel	113,425	53,570	62,675	229,670
Halton	69,860	15,665	20,890	106,415
Total GTA	692,826	408,231	397,274	1,498,331
		2001		
Metro	295,474	354,388	290,801	940,663
Durham	139,717	18,290	44,033	202,040
York	166,283	37,384	21,952	225,619
Peel	155,608	69,713	83,994	309,315
Halton	91,290	19,818	27,908	139,016
Total GTA	848,372	499,593	468,688	1,816,653
		2011		
Metro	295,474	401,920	307,712	1,005,106
Durham	182,093	27,580	58,122	267,795
York	210,366	49,996	26,674	287,036
Peel	183,612	89,824	100,202	373,638
Halton	119,294	25,310	38,700	183,304
Total GTA	990,839	594,630	531,410	2,116,879

Source: Hardy Stevenson and Associates, "GTA 3Rs Analysis, Social Impact Technical Document", 1993b

*** Note that 1992 data for York is shown.

disposed at Metro landfills by their approved haulers (Collis, Region of Durham, 1993). The Study Team used Metro's totals, since these are higher and provide a more conservative estimate. For instance, in 1988 Durham reported 207,957 tonnes of waste landfilled by Durham sources, whereas Metro reported 285,875 tonnes disposed by Durham sources (residential and IC&I). The numbers for subsequent years show smaller differences.

The allocation of the total waste quantity data to residential and IC&I sources was provided by Durham for all years given, and by Metro for 1990 and 1991. The Durham numbers for both residential and IC&I waste disposed were lower than the Metro numbers for all years. The Study Team used the Durham estimates for residential waste, and subtracted these from the numbers for total waste disposed (provided by Metro) to estimate the quantity of IC&I waste disposed. This method may allocate slightly too little waste generation to residential sources, and too much to IC&I, however, the difference is not expected to be significant. Historical waste generation, diversion and disposal data for Region of Durham for 1986 through 1992 are presented in Table 3.3.

Durham Residential Waste Quantity Projections

Quantities of residential waste diverted from landfill were reported to the Study Team by Durham regional staff (Collis, Region of Durham, 1993). The residential waste diverted was added to the residential waste quantities sent to landfill to estimate the total residential waste generated. The residential waste generated was divided by the population to give the residential generation rate (tonnes/capita/year). The residential waste generation rate calculated by this method was 0.31 tonnes/capita/year (t/c/y) for 1987, and 0.32 t/c/y for 1988. The generation rates for 1989 and 1990 remained constant at 0.33 t/c/y, and increased to 0.34 in 1991 and 1992. The average value of 0.33 t/c/y (excluding 1986) was used for the residential waste quantity projections.

Residential waste generation was estimated by applying the average residential waste generation rate of 0.33 t/c/y to future population projections. This calculation has assumed that residential waste generation rates will remain constant (on a per capita basis) until the year 2015. In regional projections presented in Chapter 8 of the report, the effects of potential source reduction measures on net residential waste generation are taken into account.

Residential waste generation estimates for the Region of Durham for the years 1993 to 2015 are presented in Table 3.4. The table shows that residential waste generation in the Region is estimated to increase from 144,665 tonnes in 1993 to 257,745 tonnes in the year 2015.

Table 3.3

Residential Waste Management History
Region of Durham

Year	Population	Residential Generation (Tonnes)	Residential Generation Rate (T/Cap/Yr)	Residential Diversion Rate %	RESIDENTIAL DIVERSION (Tonnes): Total Residential Diversion	Green Waste	Backyard Compost	Blue Box	Igloo & Container	Other	WASTE LANDFILLED: Residential (Durham #s) (Tonnes)	ICI (by differ.) (Tonnes)	Total (Metro #s) (Tonnes)	*As reported by Durham (Tonnes)*
1986	326,179	*101,115*	*0.31*	0.00	0						101,115	152,125	253,240	
1987	340,570	104,634	0.31	4.35	4,550					4,550	100,084	161,826	261,910	*215,479*
1988	347,837	112,036	0.32	10.68	11,970			11,970			100,066	190,509	290,575	*207,957*
1989	385,480	126,049	0.33	15.82	19,939	2,274		16,087		1,578	106,110	189,353	295,463	*225,070*
1990	397,540	132,587	0.33	18.77	24,890	2,100	525	20,459	1,788	18	107,697	190,264	297,962	*240,364*
1991	409,075	137,815	0.34	22.92	31,590	2,214	3,121	20,841	810	4,604	106,225	118,694	224,919	*183,922*
1992	422,825	141,672	0.34	27.23	38,581	8,045	5,388	17,166	2,077	5,905	103,091	62,615	165,706	*121,573*
		Average =	*0.33 (excl. 1986)*											

Notes:
1) Population data supplied by Hardy Stevenson and Associates.
2) Actual diversion numbers were given for January - June 1992; therefore, all numbers have been multiplied by 2
3) OMMRI numbers used for Blue Box diversion estimates for 1990 and 1991
4) The 1987 residential generation rate was applied to the 1986 total waste generated to calculate residential waste generated for 1986
5) Other diversion includes 613.5 tonnes of recyclables from transfer stations

Assumptions:
- Landfill numbers for Durham, as reported by Metro, are assumed to be correct.
- the discrepancy between Region of Durham landfill numbers and Metro landfill numbers is due to loads delivered by haulers not on Durham's approved list
- the residential quantities reported by Durham are assumed to be correct. The difference between Durham and Metro numbers is assumed to be IC&I waste
- the Blue Box Program began in 1988.

Table 3.4

Preliminary Waste Generation Estimate
Region of Durham

Year	Population (1)	Residential Waste (Tonnes) (2)	Number of Employees (3)	Industrial & Commercial Waste (Tonnes) (4)	Total Generation (Tonnes) (5)	Total Generation (Tonnes) (6)
1993	438,380	144,665	181,919	205,568	350,234	341,936
1994	453,880	149,780	187,388	211,748	361,529	354,026
1995	469,335	154,881	193,021	218,114	372,994	366,081
1996	484,745	159,966	198,824	224,671	384,637	378,101
1997	500,120	165,040	204,802	231,426	396,466	390,094
1998	515,450	170,099	210,959	238,384	408,482	402,051
1999	530,750	175,148	217,301	245,550	420,698	413,985
2000	546,005	180,182	223,834	252,932	433,114	425,884
2001	561,230	185,206	230,564	260,537	445,743	437,759
2002	576,425	190,220	235,117	265,682	455,902	449,612
2003	592,125	195,401	239,761	270,930	466,331	461,858
2004	607,790	200,571	244,496	276,280	476,851	474,076
2005	623,420	205,729	249,325	281,737	487,466	486,268
2006	639,025	210,878	254,249	287,301	498,180	498,440
2007	654,600	216,018	259,270	292,975	508,993	510,588
2008	670,160	221,153	264,391	298,762	519,915	522,725
2009	685,690	226,278	269,613	304,663	530,940	534,838
2010	701,740	231,574	274,938	310,680	542,254	547,357
2011	717,780	236,867	280,368	316,816	553,683	559,868
2012	733,770	242,144	283,142	319,950	562,095	572,341
2013	749,695	247,399	285,944	323,117	570,516	584,762
2014	765,465	252,603	288,773	326,313	578,917	597,063
2015	781,045	257,745	291,631	329,543	587,288	609,215

Notes:

(1) Population data from Clayton Research Associates Ltd., Hardy Stevenson and Associates (Feb/93).

(2) Population projection multiplied by 0.33 tonnes/capita/year (based on historical data)

(3) Employment data supplied (Hardy Stevenson and Associates 1993)

(4) Number of employees (col. 3) multiplied by 1 13 tonnes/employee/year (based on 1987 data)

(5) Column 2 plus Column 4

(6) Population (Col. 1) multiplied by 0.78 tonnes/cap/yr (1987 Total Gen. Rate divided by population)

3.2.4 Residential Waste Generation Estimates for Metropolitan Toronto

Metropolitan Toronto Waste Disposal Data

Approximately 70% of Metro's waste is disposed at the Keele Valley landfill site, and the remainder is disposed at the Brock West landfill. The Study Team obtained data for waste generated in Metropolitan Toronto and disposed at Brock West and Keele Valley landfills for the years 1986 through 1992 from the Metro Works Department (Scanga, Metro Works, 1993).

The allocation of waste to residential and IC&I sources was provided by Metro for all years given. The historical data for 1986 through 1992 are presented in Table 3.5.

Metro Residential Waste Quantity Projections

The estimated residential waste generated was divided by the population to give the residential generation rate (in t/c/y). The generation rate remained relatively constant between 1986 and 1992. The estimated residential generation rate was 0.46 t/c/y for 1986, 0.48 for 1987 and 1988, 0.50 for 1989, 0.49 for 1990, 0.45 for 1991, and 0.47 for 1992. The average value of 0.48 t/c/y was used for the residential waste quantity projections. This rate is higher than the residential rates calculated for other GTA Regions. However, it includes some light commercial waste, which is a significant component (up to 25% in the case of City of Toronto) of the "residential" waste delivered to Metro landfills by member municipalities.

Residential waste generation projections were estimated by applying the average residential waste generation rate of 0.48 t/c/y to future population projections. This calculation has assumed that residential waste generation rates will remain constant (on a per capita basis) until the year 2015. In regional projections presented in Chapter 8 of the report, the effects of potential source reduction measures on net residential waste generation are taken into account.

Residential waste generation estimates for Metropolitan Toronto for the years 1993 to 2015 are presented in Table 3.6. The table shows that residential waste generation in Metro is estimated to increase from 1,113,380 tonnes in 1993 to 1,223,693 tonnes in the year 2015.

Table 3.5

Residential Waste Management History
Metropolitan Toronto

Year	Population	Residential Generation (Tonnes)	Residential Generation Rate (T/Cap/Yr)	Residential Diversion Rate %	Total Residential Diversion	RESIDENTIAL DIVERSION (Tonnes) Green Waste	Backyard Compost	Blue Box	Igloo & Container	Other	WASTE LANDFILLED Residential (Tonnes)	ICI (Tonnes)	Total (Tonnes)
1986	2,175,900	1,007,243	0.46	0.00	0						1,007,243	1,445,857	2,453,100
1987	2,125,520	1,021,576	0.48	2.11	21,554	4,639		16,915			1,000,022	1,490,098	2,490,120
1988	2,133,559	1,028,254	0.48	3.85	39,592	13,537		26,055			988,662	1,405,066	2,393,728
1989	2,130,855	1,060,206	0.50	8.00	84,821	22,241		62,580			975,385	1,241,573	2,216,958
1990	2,137,204	1,056,072	0.49	10.67	112,640	27,082	9,980	75,065		513	943,432	1,169,697	2,113,129
1991	2,275,800	1,015,417	0.45	16.40	166,494	56,445	16,660	85,054		8,335	848,923	704,492	1,553,415
1992	2,298,031	1,077,245	0.47	19.37	208,632	71,062	25,200	99,671	2,611	10,088	868,613	200,015	1,068,628
		Average =	*0.48*										

Notes:

1) Population data from Hardy Stevenson and Associates, 1993.
2) Green waste includes leaves, yard waste & Xmas trees
3) Residential waste is "Municipal waste" which includes residential, light commercial collected by municipal forces, street sweepings, catch basin cleanings, Parks Dept. wastes
5) 1991 landfill total revised to include Symes transfer station, contaminated soil and sewage sludge quantities

Table 3.6

Preliminary Waste Generation Estimate
Metropolitan Toronto

Year	Population (1)	Residential Waste (Tonnes) (2)	Number of Employees (3)	Industrial & Commercial Waste (Tonnes) (4)	Total Generation (Tonnes) (5)	Total Generation (Tonnes) (6)
1993	2,320,480	1,113,830	1,477,116	1,610,056	2,723,887	2,738,166
1994	2,343,148	1,124,711	1,489,836	1,623,921	2,748,632	2,764,915
1995	2,366,037	1,135,698	1,502,666	1,637,906	2,773,604	2,791,924
1996	2,389,150	1,146,792	1,515,607	1,652,012	2,798,804	2,819,197
1997	2,404,140	1,153,987	1,528,659	1,666,238	2,820,226	2,836,885
1998	2,419,130	1,161,182	1,541,823	1,680,587	2,841,769	2,854,573
1999	2,434,120	1,168,378	1,555,101	1,695,060	2,863,438	2,872,262
2000	2,449,110	1,175,573	1,568,493	1,709,657	2,885,230	2,889,950
2001	2,464,100	1,182,768	1,582,000	1,724,380	2,907,148	2,907,638
2002	2,470,430	1,185,806	1,592,104	1,735,393	2,921,200	2,915,107
2003	2,476,760	1,188,845	1,602,273	1,746,478	2,935,322	2,922,577
2004	2,483,090	1,191,883	1,612,507	1,757,633	2,949,516	2,930,046
2005	2,489,420	1,194,922	1,622,807	1,768,860	2,963,781	2,937,516
2006	2,495,750	1,197,960	1,633,172	1,780,157	2,978,117	2,944,985
2007	2,502,080	1,200,998	1,643,603	1,791,527	2,992,526	2,952,454
2008	2,508,410	1,204,037	1,654,102	1,802,971	3,007,008	2,959,924
2009	2,514,740	1,207,075	1,664,667	1,814,487	3,021,562	2,967,393
2010	2,521,070	1,210,114	1,675,299	1,826,076	3,036,190	2,974,863
2011	2,527,400	1,213,152	1,686,000	1,837,740	3,050,892	2,982,332
2012	2,532,890	1,215,787	1,696,769	1,849,478	3,065,265	2,988,810
2013	2,538,380	1,218,422	1,707,606	1,861,291	3,079,713	2,995,288
2014	2,543,870	1,221,058	1,718,513	1,873,179	3,094,237	3,001,767
2015	2,549,360	1,223,693	1,729,490	1,885,144	3,108,837	3,008,245

Notes:

(1) Population data prepared by Clayton Research Associates Ltd., Hardy Stevenson & Associates, Feb./93

(2) Population projection multiplied by 0.48 tonnes/capita/year (based on historical data)

(3) Employment data (Clayton Research Associates Ltd., 1991)

(4) Number of employees (col. 3) multiplied by 1.09 tonnes/employee/year (based on 1987 data)

(5) Column 2 plus Column 4

(6) Population (Col. 1) multiplied by 1.18 tonnes/cap/yr (1987 Total Gen. Rate divided by population)

3.2.5 Residential Waste Generation Estimates for Region of York

York Waste Disposal Data

The majority of York Region's solid waste is disposed in Metro's Keele Valley landfill. The disposal needs of some of the smaller communities in the northern part of the Region are served by landfills in Georgina and King Townships. The Study Team obtained data for waste generated in York Region and disposed at Keele Valley landfill for the years 1988 through 1992 from Metro Toronto. The 1986 and 1987 landfill data were taken from the IWA DAC for Metro Toronto and Region of York (Interim Waste authority Ltd., 1991). Estimates of the quantities disposed at the smaller landfills were provided to the Study Team by Region of York staff (Flewelling, Region of York, 1993).

The allocation of waste to residential and IC&I sources was provided by Metro for 1988 through 1992 (Scanga, Metro Works, 1993). The residential quantities for 1986 and 1987 were estimated based on the residential waste percentage reported in the Waste Management Study for the Region of York (MacLaren Engineers, 1989). The same residential percentage was used for the estimated quantities being disposed at the Georgina and King landfills. The historical data for 1986 through 1992 are presented in Table 3.7.

York Residential Waste Quantity Projections

Waste diversion in York Region is carried out at the municipal level, and there is very little diversion information available at the Regional level. Each municipality was contacted by the Study Team in February and March, 1993 to obtain current and historical waste diversion data.

Available information on the residential waste diverted was added to the residential waste quantities sent to landfill to estimate the total residential waste generated. The estimated residential waste generated each year was divided by the population in that year to estimate the residential waste generation rate (in t/c/y). Based on the available data, the estimated residential waste generation rate fluctuated considerably from year to year. The estimated generation rate (in t/c/y) was 0.29 for 1986, 0.41 for 1987, 0.38 for 1988, 0.32 for 1989, 0.38 for 1990, 0.35 for 1991, and 0.38 for 1992. The rate for 1986 was considered an outlier and was not used in developing residential waste generation estimates. An average rate of 0.37 t/c/y was calculated (excluding 1986), and was used for the residential waste quantity projections.

Residential waste generation was estimated by applying the average residential waste generation rate of 0.37 t/c/y to future population projections. This calculation has assumed that residential waste generation

Table 3.7

Residential Waste Management History
Region of York

Year	Region of York Population	Residential Generation (Tonnes)	Residential Generation Rate (T/Cap/Yr)	Residential Diversion Rate %	RESIDENTIAL DIVERSION (Tonnes): Total Residential Diversion	Green Waste	Backyard Compost	Blue Box	Igloo & Container	Other	Total ICI	WASTE LANDFILLED: Residential (Tonnes)	ICI (Tonnes)	Total (Tonnes)
1986	350,602	103,350	0.29									103,350	221,650	325,000
1987	386,103	158,295	0.41									158,295	339,487	497,782
1988	409,292	157,013	0.38	3.18	5,000			5,000				152,013	336,712	488,725
1989	442,022	140,711	0.32	5.22	7,352	752		6,600				133,359	377,296	510,655
1990	466,791	179,558	0.38	17.91	32,158	8,100		24,058				147,400	303,689	451,089
1991	504,981	174,532	0.35	21.11	36,839	9,400		27,439				137,693	161,643	299,336
1992	522,248	198,313	0.38	28.32	56,163	16,300	6,972	25,433		7,458		142,150	26,434	168,583
		Average =	*0.37* (excl. 1986)											

Notes:

1) Population and employment data from Hardy Stevenson and Associates, 1993
2) 25000 tonnes added to total waste landfilled for the Township of King and Georgina Landfills for 1986-1991; 15000 tonnes added for 1992. (Flewelling, Region of York 1993)
3) 1990 - 1991 Blue Box quantities supplied by OMMRI (Boland, OMMRI, 1993)
4) 1992 Blue Box quantities: supplied by Markham, Richmond Hill, and Region of York
5) 1988 and 1989 Blue Box quantities for Markham only
6) 1988 Residential landfill quantity from Table 2-1, (MacLaren Engineers 1989)
7) 1988 Residential landfill percentage applied to 1986 and 1987 to calculate quantity going to landfill (31.8%)

rates will remain constant (on a per capita basis) until the year 2015. In regional projections presented in Chapter 8 of the report, the effects of potential source reduction measures on net residential waste generation are taken into account.

Residential waste generation estimates for the Region of York for the years 1993 to 2015 are presented in Table 3.8. The table shows that residential waste generation in the Region is estimated to increase from 199,839 tonnes in 1993 to 329,199 tonnes in the year 2015.

3.2.6 Residential Waste Generation Estimates for Region of Peel

Peel Waste Disposal Data

The Regional Municipality of Peel's waste is disposed of primarily in the Britannia landfill site, with small quantities of waste going to the Caledon and Albion landfill sites. Landfill disposal quantities were supplied by Peel Regional staff for 1987 through 1992. The 1986 landfill disposal data were taken from the IWA DAC for the Region of Peel (Interim Waste Authority Ltd., 1991).

The allocation of waste to residential and IC&I sources was provided by Region of Peel staff for all years given. The historical data for 1986 through 1992 are presented in Table 3.9.

Peel Residential Waste Quantity Projections

Quantities of residential waste diverted from landfill were reported by Region of Peel staff (Morgan-Fraser, Region of Peel, 1993). The residential waste diverted was added to the residential waste quantities sent to landfill to estimate the total residential waste generated. The residential waste generated was divided by the population to give the residential generation rate (in t/c/y). The rate was relatively constant between 1987 and 1992. The generation rate was 0.40 t/c/y for 1987 and 1988, 0.44 for 1989, 0.43 for 1990, 0.39 for 1991, and 0.42 for 1992. The 1986 generation rate was assumed to be the same as the 1987 rate (0.40). An average value of 0.41 t/c/y (excluding 1986) was used for the residential waste quantity projections.

Residential waste generation was estimated by applying the average residential waste generation rate of 0.41 t/c/y to future population projections. This calculation has assumed that residential waste generation rates will remain constant (on a per capita basis) until the year 2015. In regional projections presented in Chapter 8 of the report, the effects of potential source reduction measures on net residential waste generation are taken into account.

Table 3.8

Preliminary Waste Generation Estimate
Region of York

Year	Population (1)	Residential Waste (Tonnes) (2)	Number of Employees (3)	IC&I Waste (Tonnes) (4)	Total Generation (Tonnes) (5)	Total Generation (Tonnes) (6)
1993	540,106	199,839	271,678	429,251	629,090	599,518
1994	558,575	206,673	282,085	445,694	652,367	620,018
1995	577,675	213,740	292,892	462,769	676,509	641,219
1996	597,459	221,060	304,112	480,497	701,557	663,179
1997	615,017	227,556	315,762	498,904	726,460	682,669
1998	632,605	234,064	327,859	518,017	752,081	702,192
1999	650,193	240,571	340,419	537,862	778,433	721,714
2000	667,781	247,079	353,460	558,467	805,546	741,237
2001	685,370	253,587	367,000	579,860	833,447	760,761
2002	701,325	259,490	375,906	593,931	853,422	778,471
2003	717,280	265,394	385,027	608,343	873,736	796,181
2004	733,235	271,297	394,370	623,105	894,402	813,891
2005	749,190	277,200	403,940	638,225	915,426	831,601
2006	765,143	283,103	413,742	653,712	936,815	849,309
2007	780,277	288,702	421,560	666,065	954,767	866,107
2008	795,411	294,302	429,525	678,650	972,952	882,906
2009	810,545	299,902	437,641	691,473	991,374	899,705
2010	825,679	305,501	445,910	704,538	1,010,039	916,504
2011	840,019	310,807	454,335	717,849	1,028,656	932,421
2012	853,042	315,626	459,360	725,789	1,041,414	946,877
2013	865,270	320,150	464,440	733,815	1,053,965	960,450
2014	877,498	324,674	469,576	741,930	1,066,604	974,023
2015	889,726	329,199	474,769	750,135	1,079,334	987,596

Notes:

(1) Population data prepared by Clayton Research Associates Ltd., Hardy Stevenson and Associates, Feb./93

(2) Population projection multiplied by 0.37 tonnes/capita/yr (average rate based on historical data)

(3) Employment data from Clayton Research Associates 1991

(4) Number of employees (col. 3) multiplied by 1.58 tonnes/employee/year ('86 & '87 average rate)

(5) Column 2 plus Column 4

(6) Population (Column 1) multiplied by 1.11 tonnes/cap/year
('86 & '87 Avg. Total Gen. Rate divided by population)

Table 3.9

Residential Waste Management History
Region of Peel

Year	Population	Residential Generation (Tonnes)	Residential Generation Rate (T/Cap/Yr)	Residential Diversion Rate %	RESIDENTIAL DIVERSION (Tonnes)						WASTE LANDFILLED		
					Total Residential Diversion	Green Waste	Backyard Compost	Blue Box	Igloo & Container	Other	Residential (Tonnes)	ICI (Tonnes)	Total (Tonnes)
1986	592,170	*242,790*	*0.40*										716,385
1987	636,475	252,391	0.40								252,391	449,360	701,751
1988	667,445	264,103	0.40								264,103	478,926	743,030
1989	702,450	307,922	0.44	9.86	30,351		1,800		200		277,571	470,449	748,021
1990	724,530	312,887	0.43	12.84	40,166	3,639	5,297	30,497	250	483	272,721	361,513	634,234
1991	744,700	292,421	0.39	15.93	46,593	4,611	9,573	30,469	540	1,400	245,828	224,086	469,914
1992	763,000	317,331	0.42	20.17	64,002	7,661	13,641	34,867	5,793	2,040	253,329	44,203	297,532
		Average =	*0.41*										

Notes:

1) Population data supplied by Hardy Stevenson & Associates, 1993
2) 1991 and 1992 Green Waste totals include compost from Mississauga wet/dry project
3) 1989 Total Residential Diversion (tonnes) from SENES Consultants, 1991
4) Disposal and diversion data supplied by Region of Peel (Morgan-Frazer, L. Region of Peel, 1993)

Residential waste generation estimates for the Region of Peel for the years 1993 to 2015 are presented in Table 3.10. The table shows that residential waste generation in the Region is estimated to increase from 321,645 tonnes in 1993 to 481,135 tonnes in the year 2015.

3.2.7 Residential Waste Generation Estimates for Region of Halton

Halton Waste Disposal Data

The Regional Municipality of Halton's waste is disposed at the Halton Waste Management site in Milton. This site opened in November, 1992. Prior to this, Halton's waste was taken to the Norjohn transfer station in Burlington for export from the region. Roughly half of this waste was taken to Buffalo for disposal at Occidental, and the remainder was taken to Walker Brothers in Thorold (Torrence, Region of Halton, 1993). Landfill disposal quantities were supplied to the Study Team by Halton Regional staff for 1990 through 1992. MOEE staff provided additional data for years prior to 1990 (MOEE, 1993).

The allocation of waste to residential and IC&I sources was provided by Region of Halton and MOEE staff. The historical data for 1987 through 1992 are presented in Table 3.11.

Halton Residential Waste Quantity Projections

Quantities of residential waste diverted in the years 1990 through 1992 were reported to the Study Team by Halton Regional staff. The residential waste diverted was added to the residential waste quantities sent to landfill to estimate the total residential waste generated. The residential waste generated was divided by the population to give the residential generation rate (in t/c/y). The rate was relatively constant between 1990 and 1992. The generation rate was 0.39 t/c/y in 1990 and 1991, and 0.43 t/c/y for 1992. An average value of 0.40 t/c/y was used for the residential waste quantity projections.

Residential waste generation was estimated by applying the average residential generation rate of 0.40 t/c/y to future population projections. This calculation has assumed that residential waste generation rates will remain constant (on a per capita basis) until the year 2015.

Residential waste generation estimates for the Region of Halton for the years 1993 to 2015 are presented in Table 3.12. The table shows that residential waste generation in the Region is estimated to increase from 129,902 tonnes in 1993 to 218,906 tonnes in the year 2015.

Table 3.10

Preliminary Waste Generation Estimate
Region of Peel

Year	Population (1)	Residential Waste (Tonnes) (2)	Number of Employees (3)	Industrial & Commercial Waste (Tonnes) (4)	Total Generation (Tonnes) (5)	Total Generation (Tonnes) (6)
1993	784,500	321,645	415,679	581,951	903,596	862,950
1994	808,800	331,608	426,962	597,747	929,355	889,680
1995	833,500	341,735	438,552	613,973	955,708	916,850
1996	859,300	352,313	450,455	630,637	982,950	945,230
1997	879,500	360,595	462,682	647,755	1,008,350	967,450
1998	900,700	369,287	475,241	665,337	1,034,624	990,770
1999	921,900	377,979	488,141	683,397	1,061,376	1,014,090
2000	953,100	390,771	510,391	714,547	1,105,318	1,048,410
2001	974,300	399,463	515,000	721,000	1,120,463	1,071,730
2002	991,100	406,351	522,314	731,240	1,137,591	1,090,210
2003	1,007,900	413,239	529,733	741,626	1,154,865	1,108,690
2004	1,024,700	420,127	537,256	752,158	1,172,285	1,127,170
2005	1,041,500	427,015	544,887	762,842	1,189,857	1,145,650
2006	1,058,100	433,821	552,626	773,676	1,207,497	1,163,910
2007	1,072,100	439,561	560,474	784,664	1,224,225	1,179,310
2008	1,086,100	445,301	568,435	795,809	1,241,110	1,194,710
2009	1,100,100	451,041	576,508	807,111	1,258,152	1,210,110
2010	1,114,100	456,781	584,696	818,574	1,275,355	1,225,510
2011	1,127,900	462,439	593,000	830,200	1,292,639	1,240,690
2012	1,139,500	467,195	601,422	841,991	1,309,186	1,253,450
2013	1,150,500	471,705	609,964	853,950	1,325,655	1,265,550
2014	1,162,000	476,420	618,627	866,078	1,342,498	1,278,200
2015	1,173,500	481,135	627,414	878,380	1,359,515	1,290,850

Notes:

(1) Population data supplied by Clayton Research Associates Ltd., Hardy Stevenson and Associates, 1993

(2) Population projection multiplied by 0.41 tonnes/capita/year (based on historical data)

(3) Employment data (Clayton Research Associates Ltd. 1991)

(4) Number of employees (col. 3) multiplied by 1.4 tonnes/employee/year (based on 1987 data)

(5) Column 2 plus Column 4

(6) Population (Col.1) multiplied by 1.1 tonnes/cap/year (1987 Total Gen. Rate divided by population)

Table 3.11

Residential Waste Management History
Region of Halton

Year	Population	Residential Generation (Tonnes)	Residential Generation Rate (T/Cap/Yr)	Residential Diversion Rate %	RESIDENTIAL DIVERSION (Tonnes) Total Residential Diversion	Green Waste	Backyard Compost	Blue Box	Igloo & Container	Other	WASTE LANDFILLED Residential (Tonnes)	ICI (Tonnes)	Total (Tonnes)
1986	271,389												
1987	275,945										101,600	109,100	272,900
1988	284,994										103,400	111,100	291,100
1989	291,600					1,812					96,700	93,300	190,000
1990	297,650	115,151	0.39	20.97	24,151	3,747		20,404			91,000	101,000	192,000
1991	313,136	123,014	0.39	30.33	37,314	8,140		25,934	3,240		85,700	70,000	155,700
1992	318,893	137,018	0.43	35.19	48,218	15,000	6,168	23,450	3,600		88,800	13,800	102,600
		Average =	*0.40*										

Notes:

1) Population data supplied from Hardy Stevenson and Associates, 1993
2) Data for 1990-1992 supplied by Region of Halton Staff
3) Data for 1987-1989 supplied by MOEE staff

Table 3.12

Waste Generation Estimates
Region of Halton

Year	Population (1)	Residential Waste (Tonnes) (2)	Number of Employees (3)	Industrial & Commercial Waste (Tonnes) (4)	Total Generation (Tonnes) (5)	Total Generation (Tonnes) (6)
1993	324,756	129,902	158,565	112,581	242,484	237,072
1994	330,727	132,291	163,029	115,751	248,041	241,431
1995	336,807	134,723	167,618	119,009	253,732	245,869
1996	343,000	137,200	172,337	122,359	259,559	250,390
1997	351,538	140,615	177,189	125,804	266,419	256,623
1998	360,290	144,116	182,177	129,346	273,462	263,012
1999	369,259	147,704	187,306	132,987	280,691	269,559
2000	378,452	151,381	192,579	136,731	288,112	276,270
2001	387,873	155,149	198,000	140,580	295,729	283,147
2002	397,529	159,012	202,180	143,548	302,559	290,196
2003	407,425	162,970	206,448	146,578	309,548	297,420
2004	417,568	167,027	210,806	149,672	316,699	304,825
2005	427,963	171,185	215,256	152,832	324,017	312,413
2006	438,617	175,447	219,800	156,058	331,505	320,190
2007	449,536	179,814	224,440	159,352	339,167	328,161
2008	460,727	184,291	229,178	162,716	347,007	336,331
2009	472,197	188,879	234,016	166,151	355,030	344,704
2010	483,952	193,581	238,956	169,659	363,240	353,285
2011	496,000	198,400	244,000	173,240	371,640	362,080
2012	508,347	203,339	249,151	176,897	380,236	371,093
2013	521,002	208,401	254,411	180,632	389,033	380,331
2014	533,972	213,589	259,781	184,445	398,033	389,800
2015	547,265	218,906	265,265	188,338	407,244	399,503

Notes:

(1) Population data from Clayton Research Associates Ltd., Hardy Stevenson and Associates (Feb/93).

(2) Population projection multiplied by 0.40 tonnes/capita/year (based on historical data)

(3) Employment data supplied by Hardy Stevenson & Associates, based on Clayton Research Associates Ltd. 1991,

(4) Number of employees (col. 3) multiplied by 0.71 tonnes/employee/year (based on 1990 data)

(5) Column 2 plus Column 4

(6) Population (Col. 1) multiplied by 0.73 tonnes/cap/yr (1990 Total Gen. Rate divided by population)

3.3 Residential Waste Composition Estimates

3.3.1 General Approach

A number of residential waste composition studies have been carried out in Southern Ontario municipalities in the past three years. These include studies in East York (Gore and Storrie Ltd., 1991), Ottawa-Carleton (R.W. Beck and Associates, 1992), Quinte (Quinte Regional Recycling 1992), Kingston (Gore and Storrie Ltd., 1992) and Guelph (City of Guelph, 1991).

The results of each study were analysed to identify the most appropriate data to use for the GTA 3Rs analysis. Each residential waste composition study used a slightly different set of waste stream component descriptions. In addition, some studies reported the composition of the combined waste stream, (before components were removed for recycling), and others reported the composition after recycling. Some of the studies contained yard waste quantities, but the studies conducted in East York and Kingston did not.

In order to rationalize the data, one component description breakdown was chosen. The data from each study were manipulated to fit into this component description. Per capita generation rates were estimated for each component of the waste stream for which data were provided. Per capita rates for wastes not included in the waste composition studies (such as yard waste and white goods) were then developed, based on an earlier study (CH2M Hill Engineering Ltd., 1991). The separate generation rates were added together to estimate a total waste generation rate. This information was then used to estimate waste composition, expressed as a % of the total waste stream, occupied by each component. Table 3.13 presents the results of these studies, modified as described above. The "Other" category includes items that could not be placed in any of the more specific categories (e.g. household hazardous waste, miscellaneous items collected at depots, MRF residue, etc.).

Results from the various studies were reasonably consistent, with some exceptions (such as newspaper). Observations are as follows:

- The percentage of newspaper ranged from 5% in Ottawa, to 16.5% in East York. On average, paper (total) comprised approximately one third of the total waste stream, with the exception of Quinte, where paper (total) was 20.8%.

- Glass ranged from 2.5% in Ottawa to 6.7% in the Township of Kingston.

- Ferrous metals ranged from 3.3% in East York to 5% in Ottawa.

- Non-ferrous metals ranged from 0.5% in the Township of Kingston to 1% in East York. (Non-ferrous metals were not broken out in the Guelph study).

- Plastics ranged from 4.5% in Quinte to 8.2% in Ottawa and City of Kingston.

- Food wastes ranged from 11.4% in Ottawa to 23.9% in the City of Kingston. Yard waste quantities were estimated to be 16.4% for East York (CH2M Hill, 1991) and 16.2% for Kingston (Township & City). Values ranged from 14.9% in Ottawa to a reported rate of 34% in Quinte. The latter set of data was collected during a period of high yard waste generation, and was ignored for this study.

- Wood waste ranged from 0.8% in East York to 4.1% in Ottawa. No value was given for Quinte.

- Construction and demolition waste ranged from 0.6% in Kingston (Township) to 1.9% in Ottawa. There were no values given for Quinte or Guelph.

- Disposable diapers ranged from 2.0% in Guelph, to 2.9% in Ottawa and Kingston (City).

- Textiles/leather/rubber ranged from 2% in Guelph to 4.4% in Kingston (Township). Used tires may have been included in some studies, but the quantities were not broken out. The only study listing a separate value for used tires was Ottawa (1%).

- Household hazardous waste ranged from 0.2% in Kingston (City) to 0.4% in Quinte.

- All other waste types were grouped under the category "Other". These quantities ranged from 2.4% in Kingston (Township) to 7.7% in Guelph.

The East York residential waste composition was chosen as being the most representative for the GTA because East York is located within the GTA, and the study was carried out relatively recently (1989). Therefore, the East York information (modified as required, to include additional waste categories not measured during the composition study) was used for residential waste composition estimates presented in the following sections. As Table 3.13 shows, the East York waste composition data agree favourably with data from the other studies for all major waste categories.

Table 3.15

Comparison Results from Southern Ontario Residential Waste Composition Studies

Component	East York (1) % composition Combined waste	Ottawa (2) % composition Combined waste	Quinte (3) % composition Combined waste	Twnshp of Kingston (4) % composition Combined waste	City of Kingston (4) % composition Combined waste	Kingston-Twn.&City % composition Combined waste	Guelph (5) % composition Combined waste
Paper							
Newspaper	16.51	5.00	9.96	10.54	9.37	9.82	12.24
Fine paper	1.41	0.70		1.94	1.28	1.54	1.59
Boxboard	3.51	3.40	3.46	3.47	4.26	3.95	2.53
Corrugated cardboard (OCC)	2.55	5.50	2.32	1.26	1.92	1.67	2.27
Magazines/Flyers	4.04	1.90	0.90	3.06	2.30	2.60	4.41
Mixed paper	6.50	4.30	2.90	9.90	10.05	9.99	3.01
Telephone books			0.23				
Composite packaging			0.88				
Other		8.90	0.10				
Subtotal (for category)	**34.51**	**29.70**	**20.75**	**30.17**	**29.18**	**29.56**	**26.05**
Glass							
Food and beverage containers	3.95	1.90	5.25	5.99	5.67	5.79	
Other	0.97	0.60	0.56	0.71	0.57	0.64	
Subtotal (for category)	**4.92**	**2.50**	**5.81**	**6.71**	**6.24**	**6.42**	**6.19**
Tinplate Steel (ferrous)							
Food and beverage containers	1.84	1.70	3.27	2.96	2.71	2.80	
White goods							
Other	1.41	3.30	1.00	1.00	0.96	0.98	
Subtotal (for category)	**3.25**	**5.00**	**4.27**	**3.96**	**3.67**	**3.78**	**3.73**
Aluminum (non-ferrous)							
Food and beverage containers	0.53	0.30	0.31	0.30	0.35	0.33	
Foil (rigid and flexible)	0.26		0.17	0.13	0.20	0.18	
Other	0.18	0.50	0.20	0.10	0.10	0.11	
Subtotal (for category)	**0.97**	**0.80**	**0.68**	**0.53**	**0.65**	**0.61**	**0.00**
Plastic							
PET	0.09	0.30	0.42	0.27	0.21	0.24	0.12
HDPE	4.39	0.50	0.60	6.17	6.40	6.31	
Other Rigid	0.26		0.66	0.41	0.44	0.43	1.04
Film	0.26	3.10	2.42	0.36	0.27	0.31	1.98
Polystyrene	0.62	0.40	0.39	0.70	0.87	0.80	0.22
Other		3.90					1.15
Subtotal (for category)	**5.62**	**8.20**	**4.49**	**7.91**	**8.19**	**8.09**	**4.51**

Table 3.13

Comparison Results trom Southern Ontario Residential Waste Composition Studies

Component	East York (1) % composition Combined waste	Ottawa (2) % composition Combined waste	Quinte (3) % composition Combined waste	Twnshp of Kingston (4) % composition Combined waste	City of Kingston (4) % composition Combined waste	Kingston-Twn.&City % composition Combined waste	Guelph (5) % composition Combined waste
Organics							
Food wastes	22.13	11.40	17.80	22.90	23.93	23.51	22.20
Yard waste (leaves,grass,weeds	*12.27*	14.70	30.40	*12.82*	*11.76*	*12.17*	22.39
Yard waste (other)	*4.13*	0.20	3.60	*4.27*	3.92	*4.06*	
Other Organics		8.20					1.78
Subtotal (for category)	38.53	34.50	51.80	39.99	39.60	39.74	46.37
Wood Waste	0.79	4.10		0.85	1.04	0.96	1.15
Const./Demolition Waste	1.49	1.90		0.61	1.05	0.88	
Drywall							
Subtotal (for category)	1.49	1.90	0.00	0.61	1.05	0.88	0.00
Disposable Diapers	2.63	2.90	2.30	2.06	2.89	2.57	2.02
Textiles/Leather/Rubber	4.04	3.60	2.46	4.43	3.85	4.08	1.99
Used Tires		1.00					
Household Hazardous Waste	0.35	0.30	0.40	0.36	0.15	0.23	0.30
Other	2.90	5.50	6.70	2.44	3.49	3.07	7.68
TOTAL	100.00	100.00	99.66	100.00	100.00	100.00	99.99

(1) (Gore and Storrie Ltd., 1991)
(2) (R.W. Beck and Associates, 1992)
(3) (Quinte Regional Recycling, 1992)
(4) (Gore and Storrie, 1992)
(5) (City of Guelph, 1991)
Yard Waste for East York and Kinston taken from CH2M Hill Engineering Ltd. 1991

The following sections use these data to estimate the composition of residential waste generated by each regional municipality in GTA in 1992. Available waste diversion data are then subtracted to estimate the quantities and composition of residential waste disposed by each GTA Region in 1992.

Residential waste generators were divided into two distinct groups: single-family plus other (including townhouses, duplexes, lowrises, etc.) households, who were assumed to generate yard waste, and multi-family households, who were assumed to generate no yard waste. For each Region, an effort was made to allocate total residential waste generation tonnages to these two groups of residential generator. This was necessary for diversion estimates as the options and recovery rates are different for multi-family and single-family dwellings. The allocation of total residential waste to single family and multi-family residents was carried out by assuming that single-family residents generate 17% per capita more than multi-family residents. The basis of this assumption is that single family households generate significant quantities of yard waste (approximately 17% of their total) and that multi-family households generate similar quantities of various waste components per capita as single family residents, but do not generate any yard waste.

The number of single-family and multi-family dwellings in each Region was then used to allocate total residential waste generation to these two groups. Subtle differences in the composition of single versus multi-family waste related to lifestyle differences were not taken into account in this analysis. The residential waste composition estimates vary somewhat from one region to another, depending on the percentage of multi-family households in the Region.

3.3.2 Residential Waste Composition Estimate for Region of Durham

Table 3.14 presents estimates of the composition of residential waste generated, diverted and disposed in Region of Durham in 1992. The table shows approximately 141,700 tonnes of residential waste was generated in 1992. It was estimated that 132,900 tonnes of this total were generated by single-family plus other households (including yard waste), and 9,480 tonnes were generated by multi-family households (excluding yard waste). An estimated 38,600 tonnes of residential waste were diverted, and 103,100 tonnes were disposed.

Table 3.14

Residential Waste Composition Estimates
Region of Durham, 1992

Component	Residential Waste Generated (Total) (tonnes)	Residential Waste Generated S-F plus Other (tonnes)	Residential Waste Generated M-F Hhlds (tonnes)	Residential Diversion (tonnes)	Residential Waste Landfilled All Households	Comp. of Disposed Waste (%) All Hhlds
Total Residential Waste (tonnes)	141,672	132,190	9,482	38,581	103,091	
Paper						
Newspaper	23,601	21,729	1,872	12,531	11,070	11
Corrugated cardboard (OCC)	3,641	3,352	289	1,446	2,195	2
Telephone Directories	334	307	26	115	219	
Mixed paper	21,761	20,035	1,727		21,761	21
Subtotal (Paper)	49,337	45,423	3,914	14,092	35,245	34
Glass	7,030	6,472	558	4,319	2,711	3
Tinplate Steel (ferrous)	5,215	4,846	369			
Aluminum (non-ferrous)	1,381	1,271	110			
Subtotal Metal (commingled)	6,596	6,118	478	3,177	3,419	3
Plastic						
PET	126	116	10	109	17	0
HDPE	6,277	5,779	498		6,277	6
Other Plastic	1,632	1,503	129		1,632	2
Subtotal (Plastic)	8,035	7,397	637	109	7,926	8
Organics						
Food wastes	31,636	29,126	2,510	3,664	27,972	27
Yard waste	21,589	21,589		9,769	11,819	11
Subtotal (Organics)	53,224	50,715	2,510	13,433	39,791	39
Wood Waste	1,130	1,040	90	621	509	0
Construction/Demolition Waste	2,134	1,965	169	752	1,382	1
Disposable Diapers	3,766	3,467	299		3,766	4
Textiles/Leather/Rubber	5,775	5,317	458	1,639	4,136	4
Other	4,645	4,276	369	439	4,206	4
Subtotal (Wood - Other)	17,450	16,066	1,384	3,451	13,999	14
TOTAL	**141,672**	**132,190**	**9,482**	**38,581**	**103,091**	**100**

Residential Diversion =

Notes:

1) This analysis assumes that 101,576 S-F and 33,913 other hhlds were served in 1992, and that there were 147,105 hhlds (single, multi and other) in total

2) Composition estimates based on East York data from Gore and Storrie Ltd 1991

3) Yard Waste (comp generated) data fromCH2M Hill Engineering Ltd 1991

4) White Goods (comp. generated) estimate (included in Tinplate Steel total) from Gore and Storrie Ltd 1991

5) The split between single and multi-family households is based on the number of households and generation rates

The residential waste generated is estimated to have consisted of:

- 17% newspaper;
- 18% other paper;
- 5.0% glass;
- 3.7% tinplate steel;
- 1% aluminum;
- 5.7% plastic;
- 22% food;
- 15% yard waste;
- 2.7% disposable diapers;
- 9.9% other materials.

Accurate diversion rates for each material cannot be estimated with the available data, as 3,451 tonnes (9% of the total recycled) is described as "other" material, without a detailed breakdown. Based on the available data, the disposed residential waste stream is estimated to have consisted of the following waste categories:

- 10% newspapers;
- 23% other papers;
- 3% glass;
- 3% metal;
- 8% plastic;
- 39% food and yard waste;
- 14% other materials.

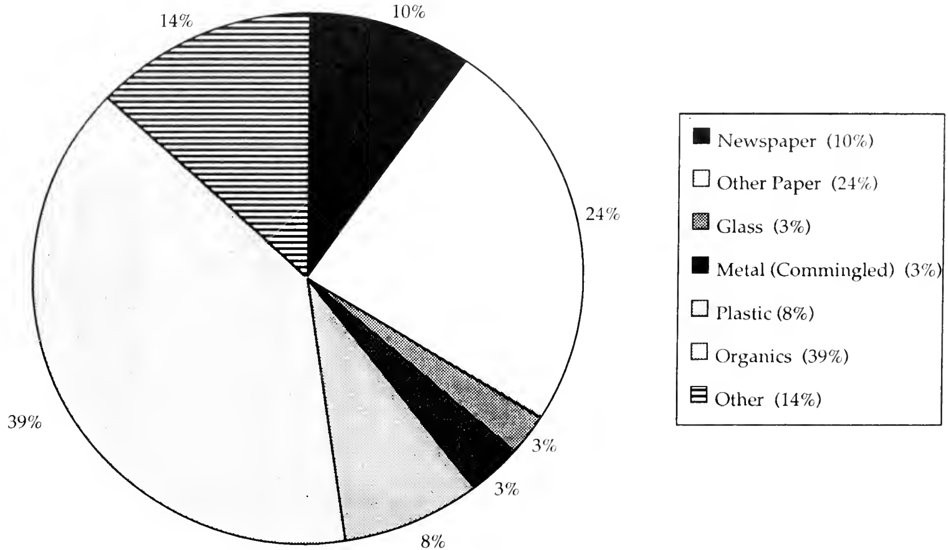
This estimated composition of disposed residential waste from Region of Durham is presented in Figure 3.1.

3.3.3 Residential Waste Composition Estimate for Metropolitan Toronto

Table 3.15 presents estimates of the composition of residential waste generated, diverted and disposed in Metropolitan Toronto in 1992. The table shows that approximately 1,077,200 tonnes of residential waste were generated in 1992. Of this total, it is estimated that approximately 732,000 tonnes were generated by single-family plus other households (including yard waste), and an estimated 345,200 tonnes were generated by multi-family households. An estimated 208,600 tonnes of residential waste were diverted, and 868,600 tonnes were disposed in 1992.

Figure 3.1

Composition of Disposed Residential Waste
Region of Durham



Note: Values shown on figure may not agree with text and Table due to rounding.

Table 3.15

Residential Waste Composition Estimates, 1992
Metropolitan Toronto

Component	Residential Waste Generated (tonnes) 1992	Residential Waste Generated S-F+Other	Residential Waste Generated M-F	Residential Diversion (tonnes) 1992	Residential Waste Landfilled (by difference) 1992	Composition of Disposed Waste %
Total Residential Waste (tonnes)	1,077,245	732,030	345,215	208,632	868,613	
Paper						
Newspaper	188,501	120,328	68,173	57,995	130,506	15
Corrugated cardboard (OCC)	29,077	18,561	10,516	2,786	26,291	3
Telephone Directories	3,166	2,025	1,141	1,098	2,068	
Mixed paper	173,303	110,623	62,680		173,303	20
Subtotal (Paper)	394,048	251,538	142,510	61,879	332,169	38
Glass	56,149	35,843	20,307	23,789	32,360	4
Tinplate Steel (ferrous)	40,255	26,838	13,417	18,314	21,941	3
Aluminum (non-ferrous)	11,029	7,040	3,989	387	10,642	1
Plastic						
PET	1,003	640	363	635	368	
HDPE	50,133	32,002	18,131	1,141	48,992	
Other Plastic	13,035	8,321	4,714		13,035	
Subtotal (Plastic)	64,171	40,963	23,208	1,776	62,395	7
Organics						
Food wastes	252,672	161,291	91,380	17,136	235,536	
Yard waste	119,551	119,551	0	79,126	40,425	
Subtotal (Organics)	372,223	280,842	91,380	96,262	275,961	32
Wood Waste	9,024	5,760	3,264		9,024	
Construction/Demolition Waste	17,045	10,881	6,165	1,500	15,545	
Disposable Diapers	30,080	19,201	10,879		30,080	
Textiles/Leather/Rubber	46,123	29,442	16,681		46,123	
Other	37,099	23,682	13,417	4,725	32,374	
Subtotal (Wood - Other)	139,371	88,966	50,404	6,225	133,146	15
TOTAL	**1,077,245**	**732,030**	**345,215**	**208,632**	**868,613**	**100**

Diversion = 19%

Notes:

1) Composition estimates based on East York data, from Gore and Storrie Ltd 1991

2) Yard Waste (generated) data from CH2M Hill Engineering Ltd 1991

3) White Goods (generated) estimate (included in Tinplate Steel total) from Gore & Storrie Ltd 1991

4) Diversion estimates from unpublished table and other tables in 1992 Metro Works Annual Report, (Nanda, Metro Toronto Works 1993)

5) White goods are included as ferrous (steel) in diversion column

6) Other category includes HHW, misc items collected at depots, and residue from MRFs

The residential waste generated in Metropolitan Toronto is estimated to have consisted of the following components:

- 17.5% newspaper;
- 19% other paper;
- 5% glass;
- 3.7% tinplate steel;
- 1% aluminum;
- 6% plastic;
- 23% food;
- 11% yard waste;
- 2.8% disposable diapers;
- 11% other materials.

Based on the available data, the disposed residential waste stream consisted of the following categories:

- 15% newspapers;
- 23% other papers;
- 4% glass;
- 4% metal;
- 7% plastic;
- 32% food and yard waste;
- 15% other materials.

These waste composition data are presented in Figure 3.2.

3.3.4 Residential Waste Composition Estimate for Region of York

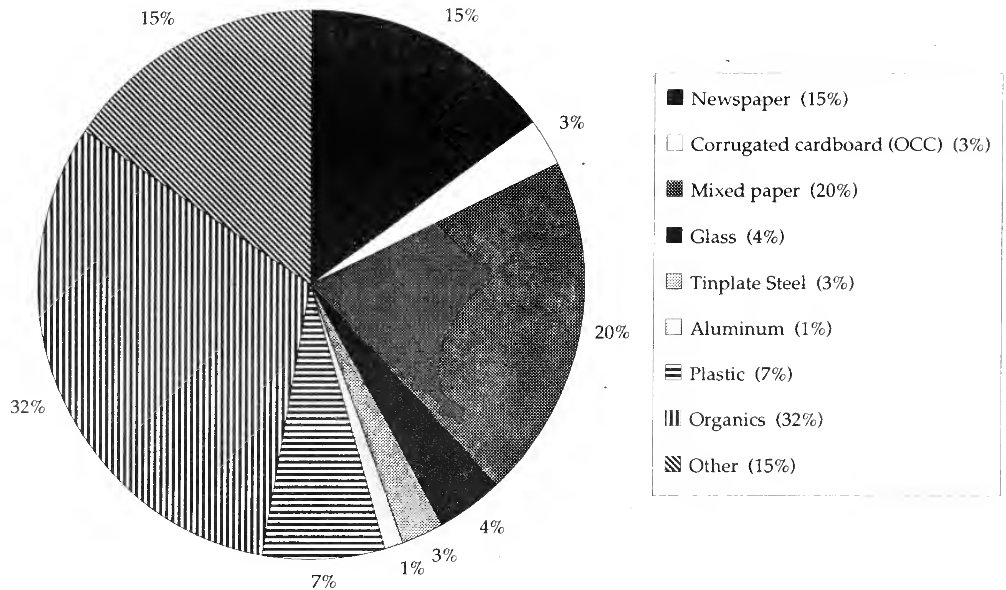
Table 3.16 presents estimates of the composition of residential waste generated, diverted and disposed in Region of York in 1992. The table shows that approximately 198,300 tonnes of residential waste were generated in 1992. It is estimated that approximately 179,200 tonnes were generated by single-family plus other households (including yard waste), and 19,100 tonnes were generated by multi-family households (excluding yard waste). An estimated 56,200 tonnes of residential waste were diverted, and 142,100 tonnes were disposed in Region of York in 1992.

The residential waste generated in Region of York is estimated to have consisted of the following components:

- 17% newspaper;
- 18% other paper;
- 5% glass;
- 3.7% tinplate steel;

Figure 3.2

Composition of Disposed Residential Waste
Metropolitan Toronto



Note: Values shown on figure may not agree with text and Table due to rounding.

Table 3.16

Residential Waste Composition Estimates
Region of York

Component	Residential Waste Generated (tonnes) All Households	Residential Waste Generated S-F+Other	Residential Waste Generated M-F	Residential Diversion (tonnes) 1992	Residential Waste Landfilled (by difference) 1992	Composition of Disposed Waste %
Total Residential Waste (tonnes)	198,313	179,158	19,155	56,163	142,150	
Paper						
Newspaper	33,232	29,449	3,783	16,641	16,591	12
Corrugated cardboard (OCC)	5,126	4,543	584	677	4,449	3
Telephone Directories	367	325	42	75	291	0
Mixed paper	30,744	27,245	3,500	69	30,676	22
Subtotal (Paper)	69,469	61,562	7,908	17,462	52,007	37
Glass	9,899	8,772	1,127	5,770	4,129	3
Tinplate Steel (ferrous)	7,313	6,568	744	2,796	4,517	3
Aluminum (non-ferrous)	1,944	1,723	221	91	1,854	1
Plastic						
PET	291	271	20	282	9	0
HDPE	8,838	7,832	1,006	404	8,434	6
Other Plastic	2,183	1,922	262		2,183	2
Subtotal (Plastic)	11,312	10,025	1,288	686	10,627	7
Organics						
Food wastes	44,545	39,475	5,071	4,741	39,804	28
Yard waste	29,259	29,259	0	18,531	10,728	8
Subtotal (Organics)	73,804	68,734	5,071	23,272	50,532	36
Wood Waste	1,591	1,410	181		1,591	1
Construction/Demolition Waste	3,005	2,663	342		3,005	2
Disposable Diapers	5,303	4,699	604		5,303	4
Textiles/Leather/Rubber	8,131	7,206	926	61	8,070	6
Other	6,540	5,796	744	6,025	515	0
Subtotal (Wood - Other)	24,571	21,774	2,797	6,087	18,484	13
TOTAL	**198,313**	**179,157**	**19,155**	**56,163**	**142,150**	**100**

Diversion = 28%

Notes:

1) Composition estimates based on East York data, (Gore and Storrie Ltd. 1991)

2) Yard Waste (generated) data (CH2M Hill Engineering Ltd 1991)

3) White Goods (generated) estimate (included in Tinplate Steel total) (Gore and Storrie Ltd 1991)

4) Diversion estimates provided by Markham, Richmond Hill and Region of York

5) Other category includes recycled materials declared from York Region at Keele Valley Landfill

6) Percentage of PET generated increased to agree with amount diverted; percentage of other plastics generated lowered proportionally

- 1% aluminum;
- 5.7% plastic;
- 22% food;
- 12.5% yard waste;
- 2.7% disposable diapers;
- 10.1% other materials.

Within the plastics category, the amount of PET reported to be diverted was found to exceed the estimated amount generated (based on East York data). The PET generation rate was increased so that estimated generation was slightly greater than diversion, and the percentage of other plastics generated was lowered by the same amount.

Accurate diversion rates cannot be estimated for each material with the available data, as 6,025 tonnes (10.7%) of the total residential waste stream recycled in 1992 is described as "other" material. Based on the available data, the disposed residential waste stream consisted of the following categories:

- 12% newspapers;
- 25% other papers;
- 3% glass;
- 4% metal;
- 7% plastic;
- 36% food and yard waste;
- 13% other materials.

These waste composition data are presented in Figure 3.3.

3.3.5 Residential Waste Composition Estimate for Region of Peel

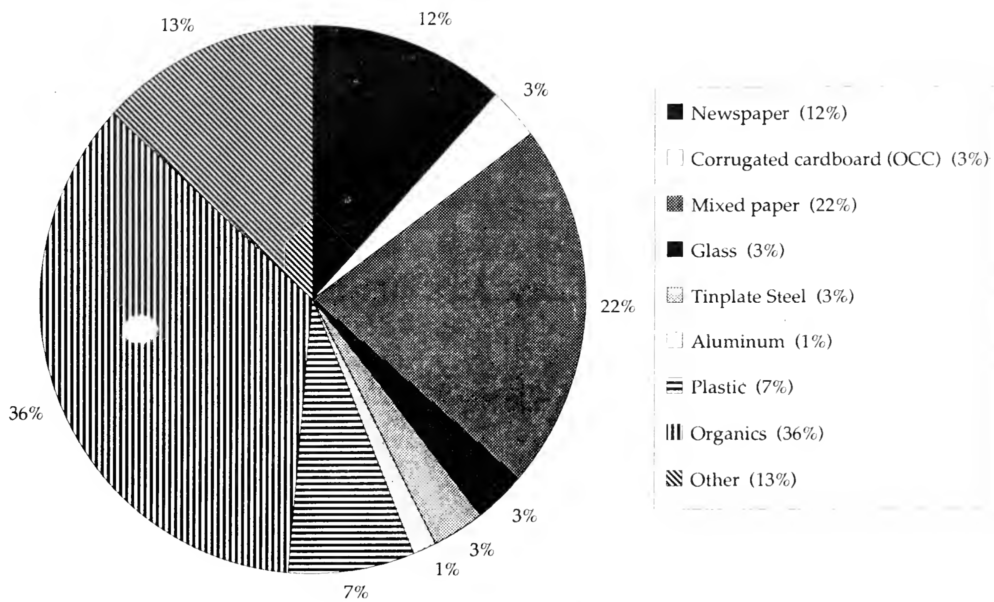
Table 3.17 presents estimates of the composition of residential waste generated, diverted and disposed in Region of Peel in 1992. The table shows that approximately 318,000 tonnes of residential waste were generated in 1992. Of this total, an estimated 243,000 tonnes were generated by single-family plus other households (including yard waste), and an estimated 75,000 tonnes were generated by multi-family households (excluding yard waste). An estimated 64,000 tonnes of residential waste were diverted, and 253,300 tonnes were disposed in Region of Peel in 1992.

The residential waste generated in Region of Peel is estimated to have consisted of the following components:

- 17% newspaper;
- 19% other paper;
- 5% glass;

Figure 3.3

Composition of Disposed Residential Waste
Region of York



Note: Values shown on figure may not agree with text and Table due to rounding.

Table 3.17

Residential Waste Composition Estimates, 1992
Region of Peel

Component	Residential Waste Generated (tonnes) - 1992 All Households	Residential Waste Generated S-F	Residential Waste Generated M-F	Residential Diversion (tonnes) - 1992	Residential Waste Landfilled (by difference) 1992	Composition of Disposed Waste %
Total Residential Waste (tonnes)	317,331	242,849	74,482	64,002	253,329	
Paper						
Newspaper	54,551	39,919	14,633	21,534	33,017	13
Corrugated cardboard (OCC)	8,415	6,158	2,257	1,234	7,181	3
Telephone Directories	872	667	205	712	160	
Mixed paper	50,197	36,703	13,494	469	49,728	20
Subtotal (Paper)	114,036	83,447	30,589	23,949	90,087	35
Glass	16,249	11,891	4,359	6,674	9,575	4
Tinplate Steel (ferrous)	12,167	8,903	3,264			
Aluminum (non-ferrous)	3,192	2,336	856			
Subtotal (Alum. + Tin)	15,359	11,239	4,120	6,137	9,222	4
Plastic						
PET	290	212	78			
HDPE	14,508	10,617	3,892			
Other Plastic	3,772	2,760	1,012			
Subtotal (Plastic)	18,571	13,589	4,981	694	17,877	7
Organics						
Food wastes	73,122	53,508	19,614	9,276	63,846	
Yard waste	39,661	39,661	0	12,026	27,634	
Subtotal (Organics)	112,783	93,169	19,614	21,302	91,481	36
Wood Waste	2,612	1,911	701	2,490	122	
Construction/Demolition Waste	4,933	3,610	1,323	142	4,791	
Disposable Diapers	8,705	6,370	2,335		8,705	
Textiles/Leather/Rubber	13,348	9,767	3,580	390	12,958	
Other	10,736	7,856	2,880	2,224	8,512	
Subtotal (Wood - Other)	40,333	29,514	10,819	5,246	35,087	14
TOTAL	317,331	242,849	74,482	64,002	253,329	100

Diversion = 20%

Notes:

1) Composition estimates based on data for East York (Gore and Storrie Ltd 1991)
2) Yard Waste (composition generated) data (CH2M Hill Engineering Ltd 1991)
3) White Goods (composition generated) estimate (included in Tinplate Steel total) (Gore and Storrie Ltd. 1991)
4) Diversion estimates obtained from Region of Peel
5) There were 56,839 backyard composters distributed at the end of 1992
6) This analysis assumes that each composter diverts 240 kg/year

- 3.8% tinplate steel;
- 1% aluminum;
- 5.9% plastic;
- 23% food;
- 13% yard waste;
- 2.7% disposable diapers;
- 9.6% other materials.

Based on the available data, the disposed residential waste stream consisted of the following categories:

- 13% newspapers;
- 23% other papers;
- 4% glass;
- 4% metal;
- 7% plastic;
- 35% food and yard waste;
- 14% other materials.

These waste composition data are presented in Figure 3.4.

3.3.6 Residential Waste Composition Estimate for Region of Halton

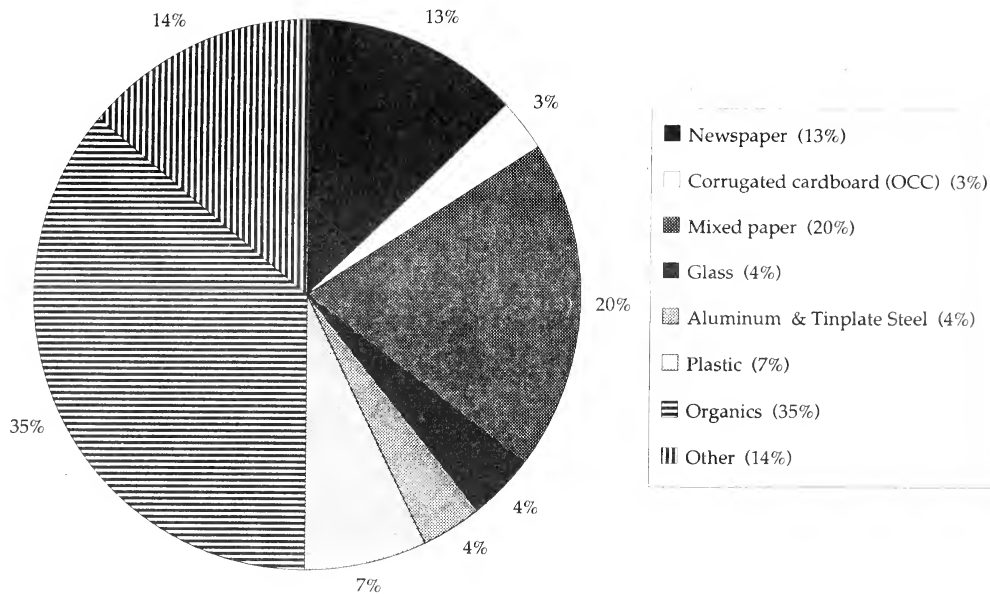
Table 3.18 presents estimates of the composition of residential waste generated, diverted and disposed in Region of Halton in 1992. The table shows approximately 137,000 tonnes of residential waste was generated in 1992. Of this, it is estimated that approximately 113,600 tonnes were generated by single-family plus other households (including yard waste), and 23,400 tonnes were generated by multi-family households (excluding yard waste). An estimated 48,200 tonnes of residential waste were diverted, and 88,800 tonnes were disposed.

The residential waste generated in Region of Halton is estimated to have consisted of:

- 17% newspaper;
- 18% other paper;
- 5% glass;
- 3.7% tinplate steel;
- 1% aluminum;
- 5.8% plastic;
- 23% food;
- 14% yard waste;
- 2.7% disposable diapers;
- 9.8% other materials.

Figure 3.4

Composition of Disposed Residential Waste
Region of Peel



Note: Values shown on figure may not agree with text and Table due to rounding.

Table 3.18
Residential Waste Composition Estimates, 1992
Region of Halton

Component	Residential Waste Generated (tonnes) 1992	Residential Waste Generated (tonnes) S-F + Other	Residential Waste Generated (tonnes) M-F	Residential Diversion (tonnes) 1992	Residential Waste Landfilled (by difference) 1992	Composition of Disposed Waste %
Total Residential Waste (tonnes)	137,018	113,577	23,441	48,218	88,800	
Paper						
Newspaper	23,298	18,669	4,629	15,923	7,375	8
Corrugated cardboard (OCC)	3,594	2,880	714	2,177	1,417	2
Mixed paper	21,811	17,478	4,334		21,811	25
Subtotal (Paper)	48,704	39,027	9,677	18,100	30,604	34
Glass	6,940	5,561	1,379	4,944	1,996	2
Tinplate Steel (ferrous)	5,075	4,164	911			0
Aluminum (non-ferrous)	1,363	1,092	271			0
Plastic						
PET	124	99	25			
HDPE	6,196	4,965	1,231			
Other Plastic	1,611	1,291	320			
Subtotal (Tin, Alum,Plastic)	14,370	11,612	2,758	3,650	10,720	12
Organics						
Food wastes	31,230	25,025	6,205	4,194	27,036	
Yard waste	18,549	18,549	0	16,974	1,575	
Subtotal (Organics)	49,779	43,574	6,205	21,168	28,611	32
Wood Waste	1,115	894	222		1,115	
Construction/Demolition Waste	2,107	1,688	419	356	1,751	
Disposable Diapers	3,718	2,979	739		3,718	
Textiles/Leather/Rubber	5,701	4,568	1,133		5,701	
Other	4,585	3,674	911		4,585	
Subtotal (Wood - Other)	17,226	13,803	3,423	356	16,870	19
TOTAL	**137,018**	**113,577**	**23,441**	**48,218**	**88,800**	**100**

Diversion = 35%

Notes:

1) Composition estimates based on data for East York obtained from the Gore and Storrie Ltd 1991

2) Yard Waste (composition generated) data obtained fromCH2M Hill Engineering Ltd 1991

3) White Goods (composition generated) estimate (included in Tinplate Steel total) taken from Gore and Storrie Ltd 1991

4) Diversion estimates provided by Region of Halton

5) There were 72,008 single-family, 16,080 multi-family and 21,592 other households in Region of Halton in 1992 (data supplied by Hardy Stevenson & Assoc)

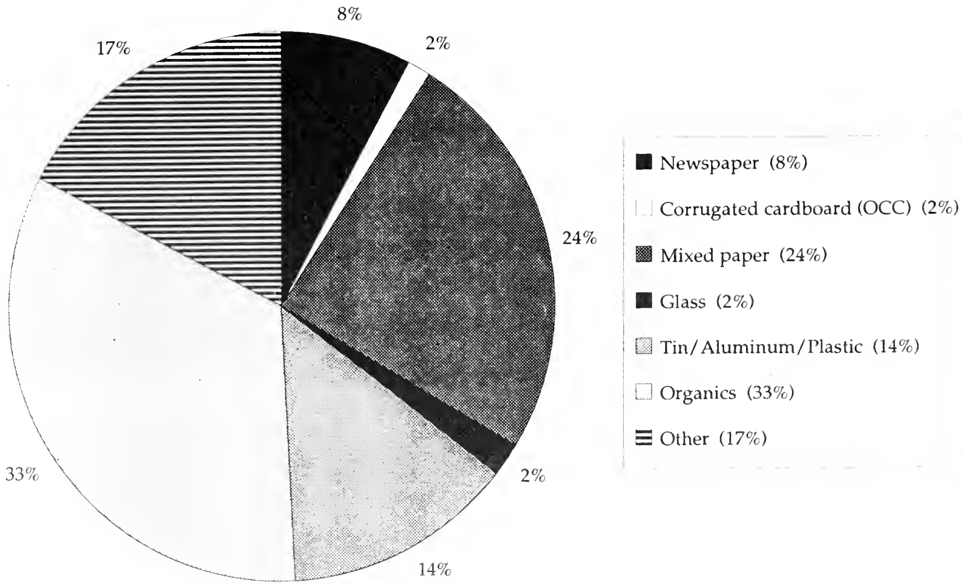
Based on the available data, the disposed residential waste stream is estimated to have consisted of the following categories:

- 8% newspapers;
- 26% other papers;
- 2% glass;
- 14% metal and plastic;
- 33% food and yard waste;
- 17% other materials.

These waste composition data are presented in Figure 3.5.

Figure 3.5

Composition of Disposed Residential Waste
Region of Halton



Note: Values shown on Figure may not agree with text and Table due to rounding.

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4.0 RESIDENTIAL SYSTEM DIVERSION ESTIMATES

4.1 Introduction

This chapter presents estimated residential waste diversion impacts for six residential waste diversion systems evaluated in this study.

Section 4.2 of this chapter describes each of the six residential waste diversion systems. Section 4.3 describes the methodology used to develop diversion estimates. Sections 4.4 to 4.8 present diversion estimates developed for each GTA Region. Detailed calculations which support the diversion estimates are presented by Region in Schedules I to M of this report.

4.2 Residential System Descriptions

Diversion estimates were developed for six residential waste diversion systems for the Regions of Durham, Metro, York and Peel. The systems are as follows:

Residential System 1	Existing
Residential System 2	Existing/Committed
Residential System 3	Direct Cost
Residential System 4	Expanded Blue Box
Residential System 5	Wet/Dry
Residential System 6	Mixed Waste Processing

A description of each system is presented in the following sections.

4.2.1 Residential System 1 - Existing

The Existing residential waste diversion system in each Region consists of a combination of components.

All regions provide curbside recycling collection of Blue Box materials to most of their single-family residents. The range of materials varies from the basic list of materials (ONP, glass, tinplate steel, aluminum and PET), to an expanded list including some or all of the following materials: OCC, telephone books, magazines, textiles, plastics, etc. Some opportunities are provided to multi-family residents to recycle, either through provision of containers in multi-family buildings, or the provision of depots at convenient locations.

All collected materials are processed in a series of MRFs which can be owned by either the Region or a private contractor. Operation of the MRF can be either by municipal forces, or by contract to the region.

Separate leaf and yard waste collection is generally provided on a seasonal basis, and these materials are composted at a series of open windrow composting sites throughout the GTA.

All regions have aggressively promoted the use of backyard composters. These units are generally provided to householders at subsidized prices, and can be either picked up at regional facilities, or delivered at an extra charge. Some regions are exploring appropriate approaches to composting for multi-family residents, but these efforts have not progressed significantly to date.

Additional waste diversion efforts include collection of Christmas trees, and bulky goods such as white goods either curbside or through drop-off depots.

Extensive promotion/education efforts have been on-going for some time, to improve participation in Blue Box and other recycling efforts, and also to encourage reuse and waste reduction as much as possible.

Existing residential waste diversion efforts diverted between 19% and 28% of the residential waste stream in all GTA regions except Halton in 1992. Halton achieved an estimated 35% diversion of residential waste in 1992.

4.2.2 Residential System 2 - Existing/Committed

The Existing/Committed System includes any commitments in the five year capital budgets of GTA regions, and any policy committments made by the end of 1992. The existing/committed system varies from one region to another. Some regions have committed significant capital to waste diversion activities, whereas other regions have stated that they do not intend to increase their recycling services.

Capital funds have been committed for the following activities by GTA regions in their five year forecasts to the end of 1997:

- central composting facilities in some regions, such as Peel, Halton and Metro;
- construction of a number of community recycling centres and depots;
- construction of new MRFs, or the expansion of existing MRFs to provide additional processing capacity;
- distribution of additional backyard composters;
- provision of recycling service to some additional multi-family units.

The existing/committed system for GTA regions also includes any policy commitments made by the end of 1992. These include:

- the 3Rs regulations, the text of which was released in draft form in April 1993;
- the National Packaging Protocol (NAPP), which is a voluntary program committed to by packaging users across Canada;
- the potential for implementation of a product stewardship model.

All GTA regions meet the requirements of the 3Rs regulations, which require that municipalities of greater than 5,000 population provide recycling services to match at least half the level of service for garbage collection. Municipalities of greater than 50,000 must provide reasonably convenient opportunities for collection of leaf and yard waste. This already occurs in the GTA where a number of municipalities offer separate curbside collection of leaf and yard waste. The requirements of the regulations can be met by provision of drop-off depots for leaf and yard waste.

The 3Rs Regulations require owners of multi-family buildings containing 6 or more units to provide recycling services. This will increase recycling efforts by multi-family residents. The extent of this increase can not be quantified at this time for a number of reasons. Firstly, the number of multi-family units in each GTA Region which are subject to the regulation is not known. Secondly, the extent to which these units are currently provided with recycling services is not known accurately. Therefore the impacts of the regulations on incremental diversion by multi-family buildings can not be quantified.

4.2.3 Residential System 3 - Direct Cost

In a Direct Cost System, waste generators pay for waste collection on the basis of the amount of waste generated. Most commonly, the rate structure increases with increased quantities of garbage collected. Direct cost is current practice for most IC&I wastes, and can be applied to the residential sector through pay-by-the-bag, selected level of service, number of cans, etc.

The advantages of a direct cost system include:

- it creates an economic incentive for waste reduction;

- municipal solid waste management costs decrease, because of the lower quantities of garbage sent for disposal;

- public understanding of solid waste management costs improves;

- residents realize direct monetary gain through waste reduction;
- residents pay in proportion to the wastes generated.

The disadvantages of a direct cost system are as follows:

- it may be initially be received negatively by the public;
- it may discriminate against low income or high occupancy households;
- it requires complex administration and can often be expensive to implement and operate;
- it may lead to illegal dumping and burning;
- it may be difficult to control some of the problem elements (such as over-stuffed and heavy bags/containers).

The Direct Cost system would build on the Existing/Committed residential waste diversion system. Residents would pay for garbage disposal in a pay-by-the-bag system. Blue Box collection of dry materials and seasonal collection and composting of leaf and yard waste would continue at current levels of service, and would be provided free of charge, to promote maximum source separation and waste diversion.

Backyard composting would be aggressively promoted, by door-to-door sales of units. Composting by multi-family residents would also be encouraged, through promotion of community composting and vermi-composting.

For the preliminary GTA analysis, it was assumed that a simple pay by the bag (or tag) system would be implemented at a cost of $0.25 to $1.00 per bag/tag. This range of charges was chosen to test the sensitivity of the municipal finance impacts to the charge levied. The higher end of the range is close to the actual cost of garbage management (Procter and Redfern, 1993, RIS 1990). The system would be supplemented with a strong promotion/education campaign to encourage the 3Rs, and explain the benefits and fairness of a direct cost system.

4.2.4 Residential System 4 - Expanded Blue Box

An Expanded Blue Box system is essentially Blue Box recycling with an expanded variety of dry recyclable materials. It attempts to achieve maximum diversion of dry recyclable materials using existing or modified facilities, and systems currently available to the Regions.

This system would include extensive promotion of backyard composting, to allow residents the opportunity to divert organics from disposal. Separate collection of leaf and yard wastes would also contribute to diversion of organics. An extensive promotion/education campaign would also be required, to ensure that householders understand which materials are included in the expanded program. Some existing municipal MRF's would likely require modifications and expansion to handle the larger quantities of materials collected by the Expanded Blue Box system.

This system is based on the Blue Box 2000 project in Quinte (Quinte Regional Recycling, 1993). It is different to a wet/dry approach (Residential System 5) in that it does not depend on central composting of household wet wastes as a component of the system.

The dry materials that would be collected in this system would include:

- newspaper (ONP);
- corrugated cardboard (OCC);
- boxboard;
- polycoat (e.g. milk cartons);
- phone books;
- magazines and catalogues (OMG);
- mixed household paper;
- steel cans;
- aluminum cans;
- aluminum trays and foil;
- clear and coloured glass;
- PET;
- rigid plastic bottles & tubes (HDPE, PVC, PP, LDPE);
- film plastic (LDPE);
- foam plastic and rigid trays (PS);
- textiles.

4.2.5 Residential System 5 - Wet/Dry System

The term "wet/dry" is commonly used to refer to a type of solid waste collection program where the householder is required to separate their waste into 2 distinct streams - the wet or the organic fraction, and the dry, which consists of fibres, plastic, metals, etc. Each stream is stored separately in a container (typically a plastic bag or bin) which, in the case of single-family residents, is then taken out to the curb for collection. In a two stream system such as the one proposed for implementation in the City of Guelph, all waste is placed into either the wet stream or the dry stream. No garbage option is

provided. Most GTA Regions favour the three stream approach, hence this was the approach used for preliminary waste diversion estimates.

Implementation of a comprehensive three stream wet/dry system in GTA Regions would require all householders to separate their waste into three streams: wet waste, dry recyclables and garbage. Carts would likely be provided to all single-family households for the collection and storage of the wet and dry waste streams. If carts are supplied, new collection vehicles would be required, which are designed to service the carts. Larger (or expanded existing) MRFs would be required to process the larger source separated dry stream. Central composting facilities would be required for processing of wet waste.

The viability of implementing successful wet/dry collection of waste from multi-family buildings in GTA is somewhat uncertain at this stage, as the garbage management system in most older buildings is typically based on a single-chute system. Many buildings provide an option for recycling of dry materials to residents, by providing bins on the ground floor, or in the basement of the building, where source separated recyclables can be deposited. A similar approach would likely be necessary for three stream wet/dry collection, where an additional bin would be provided for voluntary separation of food waste. This would likely be delivered in sealed bags by residents.

Backyard composting would continue to be promoted, and leaf and yard waste would continue to be collected separately during the growing season. This system would also require extensive promotion/education, as it requires a significant change in habits for the householder. Wet-dry systems have worked successfully in Europe for years, and have been tried on a pilot scale in Ontario.

4.2.6 Residential System 6 - Mixed Waste Processing System

Mixed Solid Waste (MSW) processing involves collecting unseparated waste and taking it all to a mixed waste processing facility. The recyclable fractions are removed, processed and marketed, where feasible, and the organic materials are composted. The residue is sent to landfill. Some facilities focus primarily on composting, while others focus on incineration.

Two approaches to mixed waste processing could be considered in GTA Regions. These are:

1. Completely replace the existing waste management system with a mixed waste processing system. In this case, all current waste diversion programs (such as Blue Box, leaf and yard waste

collection, etc.) would be cancelled, and all garbage would be collected at the curb and sent to the mixed waste plant for processing.

2. Mixed waste processing could be used to process the "third bag" of garbage currently collected at the curb, after Blue Box recycling, separate collection of leaf and yard waste and backyard composting of household organics has occurred.

Complete replacement of the existing waste management system with a mixed waste management system (eliminating all current source separation programs) is not considered to be viable in the GTA for the following reasons:

1. It contradicts provincial source separation policy: The mixed waste approach conflicts with the 3Rs focus of existing waste management policy and practice. It would negate gains that have been made through education and divert attention from reduction and reuse efforts. The full mixed waste strategy promotes an "out-of-sight, out-of-mind" attitude that would negate advances in waste reduction achieved during the last few years.

2. It erodes the current infrastructure: A mixed waste approach would require dismantling of the current recycling infrastructure, which has been developed over several years. This is considered a costly step backwards.

3. It produces low quality recyclables: The quality of recyclables diverted through source separation programs will always be higher than those which are mixed with other wastes, particularly wet organics. A greater percentage of this material is likely to be discarded as unfit for sale to secondary markets.

4. It creates disincentives to waste diversion. Mixed waste facilities are expensive to site and operate, therefore municipalities are often required to commit to provide a set amount of garbage or pay a penalty. These "put or pay" contracts eliminate incentives for communities to encourage waste reduction, contrary to the present policy in Ontario.

5. Finished compost quality may be poor: Finished compost from mixed waste plants is often contaminated with materials such as glass, plastic, household hazardous waste, etc. This contamination is difficult and expensive to manage in a mixed waste system. Compost quality is better controlled in a waste management system that includes source separation.

A full mixed waste system was ruled out for GTA on the basis that it does not meet existing policy which focuses on source separation. Mixed waste processing and composting is considered as a potential "add-on" to the Existing/Committed System, for processing of the "third bag", of garbage which remains after recyclables and leaf and yard wastes have been diverted in separate collections, and which would otherwise go to landfill. The system would involve some additional separation of recyclables at the mixed waste processing plant, and mixed waste composting of the remaining stream.

4.3 Methodology Used For Diversion Estimates

The methodology used to develop residential waste diversion system estimates was similar for each Region. The general approach (by system) is described in this section. Source reduction and backyard composting are described first, since they are components of each of the systems. These are followed by a description of the assumptions used to estimate the impacts of six residential systems in each GTA Region.

4.3.1 Source Reduction

Source reduction includes those measures that reduce materials that have the potential to become solid waste before they enter the solid waste stream. The measures may include some or all of the following:

- reduction in product volume and packaging;
- increasing product life and durability;
- promoting product redesign to encourage repair;
- purchasing products selectively to reduce product/packaging consumption;
- promoting reuse of products through refillable packages, reuse centres, garage and rummage sales;
- alternative landscaping such as xeriscaping and grass mulching;
- reducing the volume of junk mail;
- promoting repair/tailoring of appliances, clothing, footwear; and
- reduction of household hazardous wastes.

The problem encountered in quantifying source reduction results from limitations of the existing waste measurement system. The measurement system makes it extremely difficult to distinguish source reduction results from other confounding variables or noise, such as illegal dumping in the case of direct cost systems, garbaration of organic matter, increased reuse activities, etc. Despite these limitations, some communities have attempted to quantify program/activity results, including the following:

- Berkeley , California estimates that it currently diverts at least 3.3% of the waste stream through source reduction activities, including reuse centres and drop-off programs, household substitution to cloth diapers, and used clothing stores. Of this, the reuse centres and drop-off program are credited for approximately 1% of the source reduction (ILSR, 1992).

- Implementing an aggressive source reduction demonstration program, 25 families within the community of Maxville-Kenyon, Ontario reduced their waste stream by 34%. The study featured workshops attended by one member of each of the 25 families, backyard composting, and educational literature. The waste stream was measured prior to the study and after to quantify the effects of source reduction on the waste stream (RIS, 1993).

- In 1989, a survey conducted in Austin, Texas determined that 0.7% of the residential waste stream (0.4% of the total waste stream) was diverted through reuse clothing centres operating in the City. A similar survey conducted in Los Angeles determined that 1.3% of the total waste generated was diverted through thrift shops and garage sales (ILSR, 1992). Differences in the diversion rates may be attributed to the additional effort taken by the City of Los Angeles to develop and circulate brochures about the location and activities of thrift shops in the City.

- Itasca County, Minnesota tested source reduction activities in the workplace by developing a comprehensive source reduction program for its courthouse and 15 road and bridge department garages (employing approximately 350 staff). Specific source reduction activities included: switching to reusable cups, printer toners, and air filters; reducing junk mail; implementing two-sided photocopying; and using cloth roll towels. These and other measures achieved 10% reduction of the waste stream generated by the participating departments (RIS, 1992).

- The "Don't Bag It" Lawn Care Plan introduced in the State of Texas emphasizes a variety of approaches to reduce the quantity of leaf and yard waste sent for disposal. Approaches include leaving grass clippings on the lawn, and alternative lawn care strategies. The community of Plano, Texas reported a 13% reduction in the amount of grass going to landfill (Logsdon, 1991).

The National Packaging Protocol (NAPP) has targetted a 50% overall reduction in the packaging waste stream by the year 2000. NAPP had

originally required that source reduction in packaging contribute 50% of the target. If successful, this would have translated into a potential 7.5% reduction of the waste stream by the year 2000 (assuming that packaging contributes an estimated 30% to the overall waste stream). However, the NAPP source reduction targets have been eliminated, and the 50% diversion targets can now be met by whichever means are appropriate.

For the purposes of this study, it is assumed that 5% source reduction of the residential waste stream can be achieved by the year 2000, measured against a 1992 baseline. This estimate includes a conservative 3.5% reduction in packaging as a result of NAPP initiatives, and 1.5% as a result of increased reuse activities. A further allowance of an increase of 0.5% per year for additional source reduction of residential waste between the years 2000 and 2015 was considered appropriate for planning purposes, if current provincial and regional policy on source reduction promotion and education is sustained. Assuming that the original NAPP target of 7.5% source reduction may not be met, a conservative value of less than half of this target was used. The development of an active educational campaign to promote source reduction through changes in purchasing habits and changes in lifestyles (including an emphasis on reuse through goods exchange, social service agencies, and increased use of refillable/reusable packaging and containers) could increase the level of source reduction by an additional 2-3%. A value of 1.5% was considered achievable by the year 2000.

These figures do not take into consideration the effects of bans on the collection of grass clippings and other yard wastes, which could potentially contribute between 2% and 11% reduction of the waste stream requiring management outside of the home. It is considered prudent not to include these measures in source reduction calculations at this time, because of uncertainty as to whether they will be implemented in GTA.

Additional information on source reduction is provided in Schedule G.

4.3.2 Backyard Composting

The following assumptions were used to estimate the impacts of increased backyard composting activity on residential waste diversion:

- Saturation level for backyard composting was assumed to be distribution of backyard composters to 80% of single-family households. This assumption is based on data from the Centre and South Hastings Waste Management Board, where an almost 80% of householders in 15 municipalities accepted backyard composters with an aggressive door-to-door distribution program (Quinte Regional Recycling, 1993).

- It was assumed that up to 50% of "other" households would be townhouses, duplexes, etc., who would have a backyard and could accommodate a backyard composter. It was also assumed that 80% of these, (or 40% the total of other households) would also accept backyard composters. In "other" pilot projects with a strong promotional component, acceptance of composters generally has been high, ranging from 75% in Durham to 84% in Waterloo (Region of Waterloo, 1992, Compost Management Associates, 1990, 1992a, 1992b, 1993).

- Participation in backyard composting will remain high, therefore diversion will remain relatively constant. A 1992 survey of residents in Metro Toronto indicated that, of those who accepted a composter from the City over the previous three years, 98% were still using their composter (Ferguson, 1993). The survey targetted 10-12% of households who are enthusiastic users of backyard composters, and may not be indicative of how the population as a whole might respond. In Waterloo, 82% of households in the pilot area accepted composters. After 11 months, 97% were still using them (Region of Waterloo, 1992). In Pickering, after an initial 74% acceptance of composters during the first year, participation had fallen to 78% of those accepting a unit (Compost Management Associates, 1992).

- 25% of households accepting backyard composters divert 240 kg/composter/year of food and yard waste (Compost Management Associates, 1992). The remainder divert 100 kg/composter/year of food and yard waste. Informal studies in Region of Peel indicated that only the most enthusiastic residents achieve the higher diversion rate of 240 kg/composter/year, (Williams, Region of Peel, June, 1993) whereas the remainder achieve a lower rate of 100 kg/composter/year. It appears that a relatively small percentage of participants are willing to undertake the measures required to divert organics at the higher rate, which include ensuring that all kitchen vegetable scraps go into the composter, monitoring and tending the composter for maximum efficiency, and composting during the winter months.

- A 68% food, 32% yard waste ratio was used to estimate the composition of the waste diverted through backyard composters, (Compost Management Associates, 1990).

- Householders will continue to use their backyard composters, even if curbside collection of organics is provided. (Most participants

surveyed in Metro Toronto said they would continue to compost using their backyard composter even if curbside collection of food wastes was provided).

- Residents with backyard composters will continue to participate in separate collection of yard waste at the curbside. In Metro Toronto, 70% still put some yard waste out for collection in separate collection while 21% still put yard waste out with regular waste. This is thought to be affected to some extent by the size of composters, which cannot handle the quantity of yard wastes generated, and by the fact that some yard wastes are not suitable for composters (e.g. brush, etc.), requiring processing such as chipping.

Multi-family dwellings present a more difficult challenge in terms of participation in composting. Greater effort is required by multi-family unit residents, and they may not benefit directly from use of the end product. A recent demonstration project in Waterloo reported positive results, particularly with townhouse complexes (Region of Waterloo, 1992). The Recycling Council of Ontario, in association with Metro Toronto, are also examining multi-family composting. Results to date are inconclusive (RCO, 1993). Suggestions for successful programs included a strong educational program, compatibility with existing garbage/recycling programs, flexibility and a personalized approach, as multi-unit dwellings have varying populations and site characteristics.

Vermi-composters, which use worms to break down organic waste, are suitable for indoor use and for households such as apartments with limited space and low or zero generation of yard waste. However, resident acceptance of vermi-composters is somewhat limited (RCO, 1993).

Because limited data were available on the potential diversion and sustainability of multi-family composting, diversion through this activity was not included in the residential system diversion estimates.

4.3.3 Existing System

Residential waste diversion data for 1992 and earlier years were received from staff at each of the GTA Regions. In some cases, the data were requested and received from the municipalities within the Region (e.g. York). Where possible, the diversion totals were subdivided by material type (e.g. newspaper, glass, plastic, etc.).

Data received included quantities collected from the Blue Box program, leaf and yard waste pick-up, recyclables dropped off at igloos, depots, container

stations or transfer stations, and other miscellaneous recyclables collections, including household hazardous waste, white goods, bulky items, etc.

The number of backyard composters distributed in each Region by the end of 1992 were supplied to the Study Team by Regional and municipal staff. Diversion achieved through backyard composters was estimated by assuming that the first 25% of backyard composters distributed to residents divert an average of 240 kg/composter/year, and the remainder divert 100 kg/composter/year. A sensitivity analysis was carried out to determine the effect if all residents achieved the higher backyard composter diversion rate. It was assumed that 68% of the diversion achieved through backyard composters was food waste (primarily vegetable scraps), and that 32% was yard waste to estimate the composition of disposed waste (Compost Management Associates, 1990).

4.3.4 Existing/Committed System

The existing/committed system included all components of the existing system, any financial commitments made by the Regions in their five-year funding scenarios, and any policy announcements made by the end of 1992. In all cases, funding commitments were discussed with Regional staff to determine which items they thought would be going ahead in 1993, or within the five year period to 1997. Where possible, diversion estimates for these committed items were received from Regional staff. In some cases, the Study Team made assumptions where insufficient data were available.

In several Regions, funding included distribution of additional backyard composters to residents. It was assumed that the first 25% of backyard composters distributed to residents would divert an average of 240 kg/composter/year, and the remainder would divert 100 kg/composter/year, assuming a backyard composter uptake rate of 80% of single-family and 40% of "other" households, which includes duplexes, townhouses and lowrises, (see section 4.3.2 for rationale).

If central composting was committed to in the Regional budget, but collection costs (for new trucks and household containers) were not, it was assumed that the existing/committed system did not include expansion to a wet/dry or three-stream system. This was the case for Metro and York. For the Region of Peel, the committed funding actually included an allowance for household containers. Because this was clarified late in the study schedule, revisions to the existing/committed system will be made in a later draft of this report. The existing/committed system for Peel evaluated in this study does not include three stream collection.

The 3R's Regulations proposed under the Environmental Protection Act require owners of multi-family buildings containing 6 or more units to provide recycling services. This will increase recycling efforts by some multi-family residents. The extent of this increase can not be quantified at this time, for a number of reasons:

— the number of apartment units in each GTA Region which are subject to the regulation is not known. A number of sources were contacted (Regional Planning Staff, CMHC, Statistics Canada) to determine the number of units in each GTA Region which are in buildings containing six or more units. The available information on multi-family housing is not compiled in a way which can provide this number.

— the number of multi-family buildings in each Region which currently receive recycling services and are subject to the regulations is not known, therefore the incremental increase in recycling tonnages as a result of implementation of the regulations could not be estimated. Most regional staff had information on the number of units served by recycling services. However, the number of these in buildings of six or more units was not known.

The proposed 3Rs Regulations also require seasonal collection of leaf and yard waste through reasonably convenient methods for municipalities with a population of 50,000 or more. Most GTA municipalities provide some level of separate leaf and yard waste collection at curbside. A few municipalities may have to provide some additional level of service to meet the requirements of the regulations. This requirement can be met by provision of drop-off depots.

A number of product stewardship initiatives are under discussion between private industry and the Ontario Government at this time. CIPSO (Canadian Industry Packaging Stewardship Organization) has been formed to move product stewardship plans forward across Canada. If implemented, these plans will have an impact on the financial viability of municipal recycling programs, and would likely create incentives to increased residential waste diversion by municipalities. They may also result in collection of an increased range of materials by municipal programs. The impacts of these potential developments have not been included in the diversion estimates for the existing/committed systems for any of the GTA Regions.

The National Packaging Protocol (NAPP) is a voluntary initiative by Canadian Industry to reduce packaging waste by 50% by the year 2000, measured against a 1988 baseline. The impacts of NAPP for each Region are addressed in the source reduction estimates discussed in section 4.3.1.

4.3.5 Direct Cost

The Direct Cost System evaluated for the GTA 3Rs Analysis would involve free Blue Box and leaf and yard waste collection and a charge of 25¢-$1 per bag/tag for garbage disposal. The approach in this system was to provide an economic incentive for increased waste diversion and source separation on a voluntary basis, without any change to the existing level of waste management services.

Schedule C contains data and case studies on a number of direct cost systems which were reviewed to obtain data to apply to the GTA 3Rs analysis.

Data reported by a number of direct cost programs could not be used for diversion estimates in GTA, as the programs studied had residential waste diversion systems which were at a different level of development to those in GTA (which are well-developed) when the direct cost systems were implemented. A review of the available data from a number of programs indicated a significant decrease in waste generation (calculated by adding reported waste diversion and disposal quantities) in communities after a direct cost system has been implemented. Examples of these decreases include:

- Gananoque, Ontario, where garbage sent to disposal decreased by 45% after a direct cost system was implemented (Thivierge, 1992)
- Perkasie, Pennsylvania, where garbage decreased 40% after implementation of a direct cost system (Morris, 1990)
- High Bridge, New Jersey, where garbage decreased 21% (Proctor and Redfern, 1993)
- Wilkes Barre, Pennsylvania, where garbage decreased by 15% (Proctor and Redfern, 1993)
- Ilion, New York, where garbage decreased by an estimated 37% (Morris, 1990)
- Crawfordsville, Indiana, where garbage decreased by 37% in the first six months of the program (Resource Recycling, July 1993)

It was not considered prudent for the GTA 3Rs analysis to assume that implementation of a direct cost system for garbage disposal would simply reduce the quantity of garbage disposed, by the amount measured in other

jurisdictions. Instead, a more detailed assessment of likely diversion impacts was carried out on a material by material basis,.

The impacts of a direct cost system were estimated using a number of reasonable assumptions, generally based on measured response rates in other residential waste diversion programs. The impacts of behaviour change (causing source reduction) were not taken into consideration in this analysis, as the studies reviewed did not provide results considered adequately detailed to apply to the GTA.

The diversion resulting from implementation of a Direct Cost system in all GTA Regions was therefore estimated using the following assumptions:

- direct cost would be imposed on the existing/committed waste management system in each region, without any changes to the waste diversion system (i.e. additional materials would not be added to the existing/committed system). This approach was used to evaluate the impacts of imposing an economic incentive to increase waste diversion, and optimize the performance of the existing/committed system, without investing in additional recycling infrastructure.

- it was assumed that capture rates for the materials collected by the existing Blue Box system in each region (serving single-family households) would increase to at least the levels measured in the Blue Box 2000 project in Centre and South Hastings, on a material by material basis (Quinte Regional Recycling, 1993). The Blue Box 2000 capture rates were used because the program is based in Ontario, it includes backyard composting and curbside leaf and yard waste collection (which are currently components of the GTA systems), a wide range of materials are collected, and the study methodology is considered to be reliable. The capture rates used are presented in Table 4.1.

- the Blue Box 2000 capture rate for PET was not used for most Regions, as it yielded a lower diversion (in tonnes) than that currently achieved in GTA by the existing system. In these cases, the existing diversion tonnage for PET was used.

- where the capture rate for telephone directories used in the diversion estimates for the existing/committed system exceeded the Quinte capture rate, the existing/committed capture rate was used.

- Capture rates of dry materials in GTA might in fact reach levels higher than those measured in Quinte, as the Quinte levels have

Table 4.1

Quinte "Blue Box 2000" Capture Rates

Component	Quinte Capture Rates (%)
Paper	
Newspaper	82.4
Corrugated cardboard (OCC)	63.4
Telephone Directories	76.0
Mixed paper	37.5
Glass	74.5
Metal	
Tinplate Steel (ferrous)	78.0
Aluminum (non-ferrous)	81.7
Metal (commingled)	78.2
Plastic	
PET	83.4
HDPE	57.4
Other Plastic	22.0
Textiles	10.9

Source: Centre and South Hastings Waste Management Board, Quinte Regional Recycling, Blue Box 2000: The First Year, April, 1993

been achieved without a direct cost system. However, the Quinte rates are considered a reasonable, possibly conservative basis from which to estimate the potential impacts of a direct cost system on improved recovery of dry recyclables. The social impact assessment carried out as part of this study (HSA, 1993) has indicated that the Quinte project is an appropriate model for many parts of GTA.

- it was assumed that multi-family households would divert dry recyclables at 30% of the Quinte capture rate. This is likely a more realistic diversion rate for multi-family residents than the single-family rate, since it requires more effort for residents in high-rise apartment buildings to take their recyclables to a central collection point. Studies show that capture rates for depots are typically 17 - 50% of those of single-family curbside programs. (Markowitz, 1991). A 30% capture rate is a "rule of thumb" used for depot system designs (RIS, 1993), and was considered reasonable for application to multi-family households in GTA. Sensitivity analyses were run assuming 100% of Quinte capture rates for multi-family dwellings, to determine the extent to which increased participation would impact on overall system diversion.

- it was assumed that backyard composters would be distributed to 80% of single-family households and 40% of other households (townhouses, duplexes, lowrises, etc.). The first 25% of residents using backyard composters would divert 240 kg/year and the remainder would divert 100 kg/composter/year (see Section 4.3.2 for rationale). A sensitivity analysis was run to determine the effect if all residents diverted organic waste at the higher backyard composter diversion rate.

- for estimation of disposed waste composition, it was assumed that 68% of the organic material being diverted through backyard composters is food waste (kitchen vegetable scraps), and the remaining 32% consists of leaf and yard waste (see Section 4.3.2 for rationale).

- it was assumed that 80% of leaf and yard waste would be diverted by residents, either through backyard composting, or through source separation for curbside collection (free of charge). Studies in Seattle, Washington and other communities show that residents are eager to source separate and divert their waste from curbside collection, if it means a savings in the amount that they pay for curbside garbage collection (Pealy, 1992).

- no allowance was included in diversion estimates for potential diversion through composting by multi-family units. A direct cost system does not provide an economic incentive towards increased diversion for multi-family residents, as they do not pay for garbage disposal. Greater effort is required by multi-family residents to compost, and they may not benefit directly from use of the end product, therefore there are less incentives to get involved.

- the existing diversion tonnages for non-Blue Box materials (wood, construction/demolition waste, textiles/leather/rubber, and other materials) were allocated to single-family and multi-family households based on the assumption that multi-family households divert 10% of these materials. Diversion rates for these materials were assumed to stay at current levels (a conservatively low estimate).

4.3.6 Expanded Blue Box

The Expanded Blue Box system would include collection of a wide range of dry materials for recycling, and aggressive promotion of backyard composting for management of wet wastes. Schedule D contains data on a number of Expanded Blue Box programs.

The Quinte program was chosen as the model upon which the GTA systems were based, since it is based in Ontario, has been operating at full scale, serving 35,500 households for longer than 1 year, and has proven to be successful in diverting waste from landfill (A 40% diversion rate was achieved in this first year which started in November 1991). The Quinte program also includes backyard composting and curbside leaf and yard waste collection, which are already components of the existing GTA systems.

Using the Quinte Blue Box 2000 (Quinte Regional Recycling, 1993) program as a model, the diversion for an Expanded Blue Box system in all GTA Regions was estimated using the following assumptions:

- Expanded Blue Box is an "add-on" to the existing/committed system.

- Blue Box materials collected would include those collected in the existing/committed system, plus those collected in the Quinte Blue Box 2000 program.

- the estimated capture rates for "single-family plus other" households for all Expanded Blue Box materials are presented in

Table 4.1 and are the same as those measured in the Blue Box 2000 project in Quinte.

- the Blue Box 2000 capture rate for PET was not used for most Regions, as it yielded a lower diversion (in tonnes) than that currently achieved by the existing system. The existing diversion tonnage for PET was used in all Regions.

- where the capture rate for telephone directories used in the diversion estimates for the existing/ committed system exceeded the Quinte capture rate, the existing/committed capture rate was used.

- it was assumed that multi-family households would divert dry recyclables at 30% of the Quinte capture rate. (See Section 4.3.5 for rationale). Sensitivity analyses were run assuming 100% of Quinte capture rates for multi-family dwellings, to determine the extent to which increased participation would impact on overall system diversion.

- backyard composters would be distributed to 80% of single-family households and 40% of other households (townhouses, duplexes, lowrises, etc.) (see Section 4.3.2 for rationale). 68% of the organic materials being diverted through backyard composters are food waste (kitchen vegetable scraps), and the remaining 32% consist of leaf and yard waste.

- the first 25% of residents using backyard composters would divert 240 kg/year and the remainder would divert 100 kg/composter/year (see Section 4.3.2 for rationale). A sensitivity analysis was run to determine the effect if all residents diverted organic waste at the higher backyard composter diversion rate.

- no allowance was included in diversion estimates for potential diversion through composting by multi-family households (see Section 4.3.5 for rationale).

- the existing diversion tonnages for non-Blue Box materials (wood, construction/demolition waste, textiles/leather/rubber, and other materials) were allocated between single-family and multi-family households based on the assumption that multi-family households divert 10% of these materials.

4.3.7 Wet/Dry (Three-Stream)

Wet/dry collection systems are described along with some case studies in Schedule E. Four demonstration-scale programs have been completed in Ontario to research the practicality of two and three stream "wet/dry" collection systems. The host communities for these demonstration programs are City of Guelph, City of Mississauga, Region of Halton and Metro Toronto. The Town of Markham is planning a pilot-scale project in 1993-1994, and the Town of Newmarket is considering a full scale wet/dry system in 1994. Discussions with GTA Regional staff indicated that they would consider implementation of three-stream rather than two-stream wet-dry systems in the future. For this reason, all diversion estimates are based on a three-stream system.

Sources reviewed to obtain performance data on these projects included:

- — the City of Guelph (City of Guelph 1991), (Laird, City of Guelph 1992), (Bennett, 1993), (Laird, City of Guelph 1993)
- — the City of Mississauga (Proctor & Redfern Ltd., 1992), (Williams, Region of Peel, June 1993)
- — the Region of Halton (Joshua Creek) (Proctor and Redfern Limited, 1992), (Mercer, Halton Public Works, 1993)
- — Metro Toronto (Etobicoke, North York and the City of Toronto) (Metropolitan Toronto Commissioner of Works, 1992), (Sims, 1993)

The available results from these programs were obtained to assess the likely diversion impacts of implementation of a full-scale three-stream wet-dry system in GTA regions. Because participation in most of these pilot projects was voluntary, it was felt that the results required interpretation prior to applying them to each GTA Region.

The City of Guelph wet/dry pilot project began in August 1989, with 565 residences. It was expanded in July 1990 to include an additional 307 homes (825 single-family households, and 47 townhouses in total). It was the longest running residential wet/dry pilot project in North America. Residents were divided into five different areas to test five variations of the Wet/Dry system, including two-stream, three-stream, and different combinations of collection containers (i.e. bins, bags, etc.). The dry stream included all Blue Box materials plus fine, glossy and mixed paper, boxboard, OCC, wood plastic bags and metals. The wet stream included kitchen vegetable wastes and leaf and yard wastes. The 3-stream demonstration project achieved 83% recovery of organics and 78% recovery of recyclables, and the 2-stream demonstration recovered 96% of organics and 90% of recyclables. However, 92% of the recyclables in the 3-stream test project were properly segregated, versus 86% in the 2-stream. Similarly, 97% of the organics were separated correctly in the 3-

stream, versus 90% in the 2-stream. The conclusions were that the 3-stream has a lower contamination rate than the 2-stream, but the 2-stream has a higher recovery rate. The participation rate is reported to be 95% overall (Glenn, May 1993).

The City of Guelph has opted to go with the 2-stream wet/dry system, and has received a Certificate of Approval for construction of a wet/dry composting and recycling facility. This will be the first large full-scale wet/dry system in North America (there are currently two small full-scale 3-stream wet/dry systems in Fillmore and Swift Counties, Minnesota).

The Halton demonstration project involved 582 households in the Joshua Creek Community. The demonstration project involved residents separating their household waste into 3 streams: recyclables, compostables and residual waste. Data was collected by the Region of Halton on the quantity of waste collected in each of the three streams for the 52 weeks of the Joshua Creek Project. In addition, a study of the composition of the "third" (garbage) bag, sponsored by St. Lawrence Cement, was conducted (Proctor and Redfern, 1993). This study involved random sampling of 50 homes in the demonstration area on three different occasions. The results showed that a 53% recovery of organics in the wet stream, and 84% recovery of recyclables in the dry stream was achieved. These recovery rates are estimates only, based on data obtained from the third bag. Detailed results of data collected by the Region of Halton during the 52 week wet/dry demonstration project are not yet available.

Participation in Metro's pilot wet waste study was low. The study was completed in March 1993. Results of the pilot have not been released to date. The report is expected in late 1993.

The Mississauga pilot project tested a variety of collection systems for source separated organic wastes. Participation rates were much lower than for curbside recycling collection. During the first six months of the pilot (November 1991 to April 1992), the number of households in the four test areas putting organics out on a weekly basis ranged from 23 to 59%. Set-out rates were lowest in the winter and increased in the spring (Glenn, 1993).

It appears that participation levels in new programs do not reach their full potential until several years into the program. The recovery rates for dry recyclables in the different pilot projects were relatively high because residents have been participating in Blue Box programs for several years. It took several years for Ontario's voluntary Blue Box programs to achieve an estimated 75 to 85% participation rate. It is reasonable to assume that this could be the case for wet/dry systems also.

The most applicable program for GTA was found to be Guelph because it is the longest running pilot, has achieved good participation rates, and has collected considerable performance data. However, Quinte data (Quinte Regional Recycling 1993) provide more detail on capture rates per material which were needed for the GTA 3Rs analysis. For this reason, Quinte capture rates were used to estimate diversion of dry materials by a three stream system. The Quinte capture rates represent a more conservative estimate of the potential diversion. The potential diversion achievable through a three-stream wet/dry system in all GTA Regions was estimated using the following assumptions:

- three-stream wet/dry is an add-on to the existing/committed system.

- dry materials captured would include those collected in the existing/committed system, plus those collected in the Quinte Blue Box 2000 program. The Guelph program collected the same dry materials that are collected in Quinte, plus wood and metals.

- capture rates for dry recyclables in each GTA region would increase to the levels measured in the Quinte Regional Recycling Blue Box 2000 project, on a material by material basis. Quinte data were used because the Guelph study provided an overall dry recyclables capture rate, but no capture rates for individual materials. Capture rates were required by material in order to estimate the composition of disposed waste.

- multi-family households would divert dry recyclables at 30% of the Quinte capture rate (see Section 4.3.5 for rationale). Sensitivity analyses were run assuming 100% of Quinte capture rates for multi-family dwellings, to determine the extent to which increased participation would impact on overall system diversion.

- backyard composters would be distributed to 80% of single-family households and 40% of other households (townhouses, duplexes, lowrises, etc.). It was assumed that the first 25% of residents using backyard composters would divert 240 kg/year and the remainder would divert 100 kg/composter/year (see Section 4.3.2 for rationale). A sensitivity analysis was run to determine the effect if all residents diverted organic waste at the higher backyard composter diversion rate.

- for estimation of disposed waste composition, it was assumed that 68% of the organic material being diverted through backyard composters is food waste (kitchen vegetable scraps), and the

remaining 32% consists of leaf and yard waste (see Section 4.3.2 for rationale).

- it was assumed that 80% of organics (food and yard waste) would be diverted, either through curbside collection in the wet/dry system, or through the use of backyard composters. This assumption is based on the results from the Guelph 3-stream demonstration project, where 83% recovery of organics was achieved.

- no allowance was included in diversion estimates for potential diversion through composting by multi-family residents (see 4.3.2 for rationale).

- the existing diversion tonnages for non-Blue Box materials (wood, construction/demolition waste, textiles/leather/rubber, and other materials) were allocated between single-family and multi-family households based on the assumption that multi-family households divert 10% of these materials.

4.3.8 Mixed Waste Processing

Mixed waste processing is described along with some recent case studies in Schedule F. Source separation in the existing Blue Box, leaf and yard waste and backyard composting programs is estimated to divert 19 to 28% of the residential waste stream in the existing/committed systems. The mixed waste processing system would retain all current waste diversion activities and would add a mixed waste processing and composting facility to process the "third bag" of residential mixed waste that remains and is currently disposed as garbage. (The "first bag" is assumed to be dry recyclables, and the "second bag" source separated organics).

The composition of the "third bag" of waste remaining after source separation programs, including Blue Box, backyard composting and separate collection and processing of leaf and yard waste would vary on a Regional basis. The composition of the third bag of waste, entering the mixed waste plant ranges from Region to Region as follows:

• Newspaper	7 - 15%
• OCC	2 - 3%
• Mixed Paper	20 - 24%
• Glass	2 - 4%
• Steel	3%
• Aluminum	1%
• Mixed plastic	7 - 8%

- Organics 32 - 40%
- Other materials 13 - 17%

(See Chapter 3 for disposed residential waste composition by Region).

As these compositions illustrate, the majority of materials entering the mixed waste plant are either recyclable or compostable. It is therefore possible, in theory, to achieve a relatively high diversion rate with a mixed waste system added to existing source separation systems. In practice, a high percentage of the recyclable materials entering the mixed waste plant would be contaminated, and may not be marketable. In addition, the quality of compost generated by the mixed waste composting process may be low due to contamination. The quality of the finished compost will determine whether or not it is marketable.

The following assumptions were used to estimate waste diversion if a mixed waste processing facility was added to the existing/committed system in each Region.

- It is assumed that 80% of single-family, and 40% of other households use backyard composters, so that reasonable diversion of organics occurs at source.

- Separation for refuse-derived fuel (RDF) for incineration was not considered.

- 30% of ONP and 10% of mixed paper going to the mixed waste plant are recovered for recycling. 85% of the remaining ONP and mixed paper is composted while 15% of the remainder of these materials ends up in the residue.

- 50% of OCC entering the mixed waste plant is recovered for recycling. 85% of the remaining OCC (42.5%) is composted while of the 15% of the remaining OCC (7.5%) ends up as residue. Telephone directories are assumed to have a similar recovery rate.

- 20% of glass entering the mixed waste plant is recovered for recycling. The remaining 80% of glass is landfilled.

- 70% of ferrous metal is assumed to be recovered for recycling while the remaining 30% is assumed to end up in the residue stream due to contamination. Some of the recovered ferrous metal would be extracted in the front end and the remainder would be recovered at other stages (electromagnet and hand sort).

- It is assumed that 50% of the non-ferrous metal is recovered for recycling (hand sort) while the remainder is landfilled.

- All PET entering the mixed waste plant is recovered for recycling (the quantities of PET entering are not significant).

- 25% of HDPE is recovered for recycling. The remainder ends up as residue.

- All other plastics are assumed to end up as residue. Some likely would be sorted initially to keep them out of the process stream.

- All food and yard wastes that are not diverted by backyard composters considered to be sent for mixed waste composting. 90% of the yard waste is composted while 85% of the food waste is composted. The remainder ends up as residue.

- All wood sent to the MSW facility is assumed to be contaminated and non-recyclable. The larger items likely would be extracted. 10% of the remaining wood waste is composted. The remainder is landfilled.

- Most C&D waste in this stream is assumed to end up in landfill due to contamination and since it is not readily recoverable. 10% (mostly wood) is assumed to be composted and the remainder is assumed to end up as residue.

- disposable diapers go to disposal as they are currently not readily compostable.

- 10% of textiles are recovered for recycling

- all 'other' waste goes to disposal

- mass reduction of 50% in the composting process (Thompson K., Harding Lawson Associates, 1993)

- if compost quality is poor, compost will go to disposal. If compost quality is good, compost will be marketed.

4.4 Residential System Diversion Estimates for Region of Durham

Diversion estimates for the six residential systems considered for Region of Durham are presented in Schedule I. The estimates have been developed

using 1992 data for illustrative purposes. The range of diversion estimates presented in this section and used for comparative evaluation of systems is achievable in the year 2000, assuming that the system is fully operational by the year 2000. In all cases, an additional 5% is added to the high end of the range presented, to account for source reduction achievable by the year 2000. Any unique Region-specific features of the estimates are discussed in this section.

4.4.1 Region of Durham Existing System

Existing System Description

In 1992, an estimated 141,672 tonnes of residential waste were generated in Durham. Of this, 38,581 tonnes were diverted and 103,091 tonnes disposed for an estimated residential waste diversion rate of 27.2%.

Residential recycling services consisted of the following components:

- 101,576 single-family households were provided with bi-weekly curbside collection of Blue Box recyclables.
- rural residences were served by depots and containers situated throughout the region.
- Igloos and domes provided opportunities to recycle in public areas.
- 22,450 backyard composters were owned by single-family dwellings.
- extensive promotion and education programs.
- curbside pickup of leaf and yard waste in several municipalities.
- one Regional leaf and yard waste composting site.
- re-use activities by Goodwill Industries (clothes, durable goods, etc.).
- one attended donation centre at Ritson Transfer Station.
- three permanent HHW depots, including Brock West landfill (operated by Metro), Scugog transfer station, Oshawa transfer station.
- The Toxic Taxi service was discontinued in the fall of 1992.
- drop-off depot for white goods collection at Lasco Steel transfer station.
- one MRF (the Durham Recycling Centre) owned and operated by the Region.

Estimated residential waste diversion was made up of the following activities:

Blue Box curbside	17,166 tonnes
Dry Recyclables from depots	2,691 tonnes
Other Dry Recyclables diverted	5,291 tonnes
Leaf and yard waste	8,045 tonnes
Household wet waste through backyard composters	5,388 tonnes
Total diverted 1992	38,581 tonnes

This information is summarized in Table 4.2.

The following text describes residential waste diversion activities under a number of headings. All of the information was obtained from the following sources:

- Survey of regional and municipal staff in February-March, 1993 by the Study Team.

- on-going telephone communication with regional and municipal staff, and waste management contractors, February-July 1993.

- Review of Regional reports to council.

For ease of presentation, references for each value quoted will not be provided in the following text.

Residential Recycling and Collection

In 1992, the Region of Durham contained an estimated 147,105 households. Of these, 101,576 were single-family households, 11,616 were high rise apartments and 33,913 were other households, including semi-row townhouses, low-rise apartments, mobile homes etc. (Hardy Stevenson Associates, 1993).

In 1992 an estimated 123,976 single, multi-family and rural households in Durham were served with some form of recyclables collection. Of these:

- 101,576 single-family households were served with curbside collection of Blue Box materials (reported by the Regional Municipalities);
- 2,400 apartments were served with collection of recyclables (reported by OMMRI); and
- 20,000 rural residences were served by depots and containers situated throughout the region (reported by OMMRI).

Data were obtained from the local municipalities on the quantities of each material collected by curbside programs. These were somewhat different to the totals in the Region's 1992 Annual Report (Region of Durham Works Department, 1993). The latter source was used as the most comprehensive source of information. The information from the municipalities was valuable in assigning materials to different categories for waste composition estimates.

Table 4.2

Summary of Existing Residential Waste Diversion System Performance
Region of Durham
1992

Regional Characteristics	
Regional Population	422,825
Total Number of Households	147,105
— single-family	101,576
— multi-family	11,616
— other	33,913
Households served by curbside	101,576 S-F
Households served by depot	22,000
Number of backyard composters distributed	22,450
Residential Material Diverted in 1992	
Blue Box	17,166 tonnes
Depots (Blue Box materials)	2,691 tonnes
Depots (other materials)	5,291 tonnes
Leaf and yard waste collection and composting	8,045 tonnes
Diversion through backyard composters	5,388 tonnes
Total residential waste diverted	38,581 tonnes
Residential waste diversion summary	
Residential waste generated	141,672 tonnes
Residential waste diverted	38,581 tonnes
Residential waste disposed	103,091 tonnes
Residential waste diversion rate	27.2%

Sources: Hardy Stevenson Associates, 1993.
Region of Durham staff, 1993.
Durham municipal staff, 1993.

The following tonnages of materials were collected from residential (and some IC&I) sources in 1992, and were processed at the Region of Durham MRF (20,996 tonnes total, including 1,140 tonnes of OCC, mixed paper and other recyclables from the IC&I sector):

- 12;377 tonnes of ONP and OMG (commingled);
- 1,411 tonnes of OCC;
- 115 tonnes of Telephone Directories;
- 2,443 tonnes of Aluminum and Steel (commingled);
- 4,211 tonnes of Glass;
- 155 tonnes of PET;
- 284 tonnes of fine paper (not colour separated, collected only from Region and Municipal offices and a few IC&I locations, program likely to be discontinued in 1993).

In February 1992, 7 out of 8 municipalities in the region switched from weekly to bi-weekly collection of recyclables. On a regional basis, a slight reduction in gross recyclables collected was experienced (3.6%), however, some increases were noted in individual municipalities. For example, the City of Oshawa reported a 7.8% increase and the Town of Newcastle reported an 8.5% increase in the weight of materials collected curbside over 1991 (weekly) recovery levels. The switch to bi-weekly collection of recyclables resulted in an overall cost saving to the curbside collection program of 28% (RIS, 1993).

Residential Household Composting

At the end of 1992, 22,450 backyard composting units had been distributed by the Region of Durham. It is estimated that 5,388 tonnes of organic material were diverted through this program in 1992, assuming a diversion rate of 240 kg/composter/year measured in the Region.

In addition to sales through 12 distribution centres, a company called "Students for the Environment" carried out door-to-door promotion and education of home composting activity, as well as sales of composting units in the more urbanized area of the Region late in the summer of 1992. The cost for this service is added to the price of the unit, which amounted to $21 per sale in 1992.

A composting video was made for schools and other interested organizations. A portion of the funding for the project was provided by the Ministry of the Environment and Energy and Superior Propane.

Considerable research has been carried out on backyard composting programs in Durham (Compost Management Associates, 1990, 1992, 1992a, 1993). Durham Region was host to a backyard composting demonstration program

in the summer of 1989. A second backyard composting study which started in the fall of 1990 showed that backyard composting units can divert an estimated 240 kg per household per year. Amortized over a period of 10 years, this study estimated the cost of residential waste diversion through backyard composting at approximately $18.75/tonne material diverted. A full year study initiated in 1992 in the Region has shown a diversion rate of between 153 and 258 kg/household/year through backyard composting. Using the higher of the two figures, an average cost per tonne of material diverted (amortized over a 10 year period) is $23.16. The program was funded 100% by MOEE. Total cost of the home composting units was $59.35 per unit, including delivery, project monitoring and administrative costs.

Staffing to administer the backyard composting program consists of approximately 50% of a coordinator's time, as well as occasional support from any Environmental Youth Corps (EYC) students that may be available.

Residential Leaf and Yard Waste Collection/Composting Facilities

In 1992, curbside collection of "green" waste in Region of Durham totaled 7,331 tonnes. An additional 714 tonnes of leaf and yard waste were collected from transfer, depot and private sources in 1992, for a total of 8,045 tonnes. Leaf and yard waste is processed in a composting facility that was initially constructed by the Durham Regional Works Department. The site is 10 acres in size, and is located next to the Regional MRF. Equipment used on-site includes 2 front end loaders, a SCAT machine, a tub grinder and a trommel screen. Depending on the time of year, staffing ranges from 5 to 12 employees. Several modifications have been made to the composting site since 1989 by Ontario Disposal Ltd., Durham Region's composting contractor. Sale of the finished compost is the responsibility of the contractor. All compost finished in 1992 has been sold. Revenues for the material are not known.

Other Residential Waste Diversion

Reuse Activities

A new reuse venture was initiated in the fall of 1992. Residents are now encouraged to reuse goods by bringing old clothing and other items to the Goodwill trailer sites located throughout the Region. The first of these sites was set up in the fall of 1992. Two more will be established in 1993. Goodwill will recover reusable items and sell them in their stores throughout Ontario. The Region received an MOEE grant of $22,500 to implement this program.

An "attended" donation centre is located at the Ritson Transfer Station. The Regional transfer station accepts household materials such as batteries,

concrete, OCC, old clothing, scrap metal and tires. A total of 17 tonnes of material were collected in the first 3 months of operation.

Household Hazardous Waste (HHW) Program

Durham residents have access to the household hazardous waste drop-off operated by Metro Toronto at the Brock West landfill site. Other household hazardous waste sites are located at Scugog and Oshawa (i.e. paint exchange) transfer stations. Collected HHW is delivered to the storage facility at the Brock West landfill and is managed by Laidlaw Environmental Services.

The Toxic Taxi in Durham collected approximately 61 tonnes of HHW in 1992. This program was cancelled in the Fall of 1992 when the HHW drop-offs at transfer stations were opened and participation in the Toxic Taxi decreased. A total of 276 tonnes of HHW were collected from all sources in 1992.

White Goods

Durham residents may transport white goods to a transfer station for recycling at Lasco Steel. Based on data from the first six months of 1992, approximately 400 tonnes of white goods (included in the total figure shown in Table 4.2) were collected from Durham residents in 1992.

Residential Promotion and Education

The Region of Durham has been actively involved in promotion and education on 3R's topics. The Region published *A Household Guide to Waste Reduction and Recycling in Durham Region* in 1992 (Region of Durham Works 1992).

The Region has recently produced a video promoting home composting which will be aired on local cable stations. It also established an awards program aimed at recognizing significant diversion initiatives.

Public Sector Material Recycling Facilities (MRFs)

The Region is served by one public MRF, the Durham Recycling Centre, which is owned and operated by the Region. This facility is 368 square metres in size. It processed approximately 21,000 tonnes of recyclable materials in 1992, from a combination of the residential and IC&I sectors. Residue and non-recyclables comprised 1.6% of the incoming material in 1992. The MRF is operated on a 3-shift basis, 24 hours/day, 5 days/week. It is presently operating at capacity. Currently, 45 staff are employed in processing and 4 in administration.

Diversion Achieved

In 1992, approximately 38,581 tonnes of residential waste were diverted from landfill. The residential diversion rate was therefore approximately 27%. The existing system could be expected to achieve up to 32% diversion of residential waste by the year 2000. This estimate assumes that source reduction will increase to 5% (measured against a 1992 baseline), by the year 2000. Diversion estimates assume that source reduction of waste will continue to increase at an increment of 0.5% per year, from 2000 to 2015.

4.4.2 Region of Durham Existing/Committed System

Existing/Committed System Description

The existing/committed system for Durham is considered to encompass all facilities committed in the Region's capital funding budgets for the years 1993 to 1997, and any policy commitments at the local, regional, provincial or federal level, which had been announced by the end of 1992.

A review of Durham Region's 1992 Development Charges Study and the 1993 Capital and Operating Budgets and five year forecast for Waste Diversion indicated the following (Future Urban Research, 1993):

- $2,788,400 has been allocated in the 1993 capital budget for the design and construction of an expansion to the Regional Recycling Centre.

- $702,200 has been allocated in the 1993 operating budget as a result of changes to programs related to the Recycling Centre and recycling programs, including extended hours of operation, additional staff, expansion of the Igloo program and deletion of the Toxic Taxi program.

- $384,900 has been allocated in the 1993 operating budget as a result of the introduction of the sale of home composters, the Pickering Compost Study and new community events programs.

The Region is not proposing any new 3Rs programs in 1993 or within the next several years, with the exception of an allocation in the 1993 operating budget for approximately 4,000 new backyard composters, some expanded depot services, and improvements to the existing Regional MRF in Whitby. Planned changes to the MRF will likely improve processing efficiency, but the proposed collection programs are not likely to collect a significantly larger quantity of materials.

Implementation of the 3Rs Regulations proposed under the Environmental Protection Act will not impact residential waste diversion practices by municipalities within the region, as all municipalities meet the requirements of the proposed regulations for residential waste management. However, under the regulations owners of buildings containing 6 or more apartments must provide recycling to residents. This will increase recycling by multi-family residents in the Region, although the impacts cannot be quantified for a number of reasons. Firstly, the number of apartments in Durham which are in buildings of six or more units, and are therefore subject to the regulations is not known. Secondly, the extent to which units subject to the regulation currently receive recycling services is not known. Therefore, the incremental impacts of the regulation on multi-family recycling in Durham could not be estimated.

Diversion Achieved

The existing/committed residential waste diversion system is estimated to divert 28% to 33% of the residential waste stream by the year 2000. Both estimates assume that the additional backyard composters would divert 240 kg/composter/year, which would amount to additional diversion of 960 tonnes/year, and a total diversion rate of 28%. The higher estimate of 33% assumes that source reduction will increase to 5% (measured against a 1992 baseline) by the year 2000.

4.4.3 Region of Durham Direct Cost System

The assumptions listed in the Direct Cost methodology section (Section 4.3.5) apply to the analysis conducted for the Region of Durham. The Direct Cost system builds on the existing/committed system. Diversion estimates for this system ranged from 43 - 48% in the Region of Durham (excluding source reduction). Both estimates assume that 80% of leaf and yard waste would be diverted by curbside collection and backyard composting. The lower estimate assumes that 25% of households using backyard composters would divert 240 kg/composter/year, and the remainder (55% of single-family households, 15% of other households) would divert 100 kg/composter/year. In addition, the lower rate assumes that multi-family households would divert existing Blue Box materials (ONP, OCC, telephone directories, glass, metals and PET) at 30% of the Quinte capture rate. Since the existing capture rate for PET exceeds the Quinte capture rate, the existing Region of Durham capture rate (86.5%) was used.

The higher estimate (48%) assumes that all households using backyard composters would divert 240 kg/composter/year, and that multi-family households would divert existing Blue Box materials at the Quinte capture rates. Source reduction is not included in this estimate.

The 5% difference between the high and low rates of diversion was the lowest of all of the GTA Regions. This is due to the relatively small proportion (8%) of multi-family households in Durham (Hardy Stevenson and Associates, 1993). The low rate assumes that multi-family residents would divert Blue Box materials at 30% of the single-family rate, thus, the larger the number of multi-family residents, the greater the impact on the diversion sensitivity analysis.

4.4.4 Region of Durham Expanded Blue Box System

The assumptions listed in the Expanded Blue Box methodology section (Section 4.3.6) apply to the analysis conducted for the Region of Durham. The Expanded Blue Box system builds on the existing/committed system. Diversion estimates for this system ranged from 48 - 56% in Region of Durham (excluding source reduction). The lower estimate assumes that 25% of households using backyard composters would divert 240 kg/composter/year, and the remainder (55% of single-family households, 15% of other households) would divert 100 kg/composter/year. In addition, the lower rate assumes that multi-family households would divert Expanded Blue Box materials at 30% of the Quinte capture rate. Since the existing capture rate for PET exceeds the Quinte capture rate, the existing Region of Durham capture rate (86.5%) was used.

The higher diversion rate (56%) assumes that all households using backyard composters would divert 240 kg/composter/year, and that multi-family households would divert Expanded Blue Box materials at the Quinte capture rates. Source reduction is not included in this estimate.

The 8% difference between the high and low rates of diversion was the second lowest of all of the GTA Regions (after the Region of York). This is due to the relatively small proportion of multi-family households in Durham.

4.4.5 Region of Durham Wet/Dry System

The assumptions listed in the three-stream Wet/Dry methodology section (Section 4.3.7) apply to the analysis conducted for the Region of Durham. The three stream wet/dry system builds on the existing/committed system. Diversion estimates for this system ranged from 61 - 64% in Region of Durham (excluding source reduction). Both the high and low diversion estimates assume that 80% of leaf and yard waste would be diverted through curbside collection and backyard composting. The lower estimate assumes that multi-family households would divert 30% of their food waste through wet collection, and "single-family plus other" households would divert 80%

of their wet waste through wet curbside collection plus backyard composting. In addition, the lower rate assumes that multi-family households would divert Expanded Blue Box materials at 30% of the Quinte capture rate. Since the existing capture rate for PET exceeds the Quinte capture rate, the existing Region of Durham capture rate (86.5%) was used.

The higher diversion rate (64%) assumes that all households would divert 80% of their food waste. "Single-family plus other" households would divert their food waste through wet curbside collection and backyard composting; multi-family households would divert their food waste through wet collection. In addition, multi-family households would divert Expanded Blue Box materials at the Quinte capture rates. Source reduction is not included in this estimate.

The 3% difference between the high and low rates of diversion was the lowest of all of the GTA Regions. This is due to the relatively small number of multi-family households in the Region of Durham.

4.4.6 Region of Durham Mixed Waste Processing System

The assumptions listed in the Mixed Waste Processing methodology section (Section 4.3.8) were used to estimate the diversion impacts of the mixed waste processing system in the Region of Durham. The Mixed Waste Processing system builds on the existing/committed system. Diversion estimates for this system ranged from 60-63% (for compost landfilled) up to 79% (for compost marketed), excluding source reduction. The lower estimate assumes that 25% of households using backyard composters would divert 240 kg/composter/year, and the remainder (55% of single-family households, 15% of other households) would divert 100 kg/composter/year. The higher estimates assume that all households using backyard composters would divert 240 kg/composter/year.

4.4.7 Region of Durham Summary

The detailed waste composition calculations for each of the six systems discussed above are shown in Schedule I. Included for each system are two sets of analyses: a base case or low diversion estimate, with low backyard composter and multi-family dry recyclables diversion (as discussed above), and a sensitivity analysis with higher backyard composter and multi-family dry recyclables diversion. Tables 4.3 and 4.4 summarize the detailed diversion estimates for each of the two sets of analyses.

Table 4.3
Residential System Diversion Estimates (Base Case)
Region of Durham

Component	Existing System Diversion (tonnes)	Existing/ Committed System Diversion (tonnes)	Direct Cost System Diversion (tonnes)	Expanded Blue Box System Diversion (tonnes)	Wet/Dry System Diversion (tonnes)	MSW plus E/C plus Composting (landfilled) (tonnes)	MSW plus E/C plus Composting (marketed) (tonnes)
Total Residential Waste (tonnes)	38,581	39,541	61,133	67,900	86,805	84,518	110,123
Paper							
Newspaper	12,531	12,531	18,368	18,368	18,368	19,146	22,439
Corrugated cardboard (OCC)	1,446	1,446	2,180	2,180	2,180	3,010	3,476
Telephone Directories	115	115	240	240	240	271	317
Mixed paper				7,699	7,699	10,500	18,823
Subtotal (Paper)	14,092	14,092	20,787	28,486	28,486	32,926	45,056
Glass	4,319	4,319	4,947	4,947	4,947	4,861	4,861
Tinplate Steel (ferrous)						0	0
Aluminum (non-ferrous)						0	0
Subtotal Metal (commingled)	3,177	3,177	4,896	4,896	4,896	5,427	5,427
Plastic							
PET	109	109	109	109	109	126	126
HDPE				3,403	3,403	1,569	1,569
Other Plastic				339	339	0	0
Subtotal (Plastic)	109	109	109	3,851	3,851	1,695	1,695
Organics							
Food wastes	3,664	4,317	9,673	9,673	24,054	19,007	28,341
Yard waste	9,769	10,076	17,271	12,597	17,271	16,643	20,689
Subtotal (Organics)	13,433	14,393	26,944	22,270	41,325	35,650	49,031
Wood Waste	621	621	621	621	621	646	672
Construction/Demolition Waste	752	752	752	752	752	821	890
Disposable Diapers			0	0	0	0	0
Textiles/Leather/Rubber	1,639	1,639	1,639	1,639	1,639	2,053	2,053
Other	439	439	439	439	439	439	439
Subtotal (Wood - Other)	3,451	3,451	3,451	3,451	3,451	3,959	4,054
TOTAL	38,581	39,541	61,133	67,900	86,955	84,518	110,123
Low Diversion Estimate =	27%	28%	43%	48%	61%	60%	78%

Table 4.4
Residential System Diversion Estimates (Sensitivity Analysis)
Region of Durham

Component	Existing System Diversion (tonnes)	Existing/ Committed System Diversion (tonnes)	Direct Cost System Diversion (tonnes)	Expanded Blue Box System Diversion (tonnes)	Wet/Dry System Diversion (tonnes)	MSW plus E/C plus Composting (landfilled) (tonnes)	MSW plus E/C plus Composting (marketed) (tonnes)
Total Residential Waste (tonnes)	38,581	39,541	68,711	78,878	90,658	89,357	111,267
Paper							
Newspaper	12,531	12,531	19,448	19,448	19,448	19,146	22,439
Corrugated cardboard (OCC)	1,446	1,446	2,308	2,308	2,308	3,010	3,476
Telephone Directories	115	115	254	254	254	271	317
Mixed paper				8,152	8,152	10,500	18,823
Subtotal (Paper)	14,092	14,092	22,009	30,161	30,161	32,926	45,056
Glass	4,319	4,319	5,238	5,238	5,238	4,861	4,861
Tinplate Steel (ferrous)						0	0
Aluminum (non-ferrous)						0	0
Subtotal Metal (commingled)	3,177	3,177	5,158	5,158	5,158	5,427	5,427
Plastic							
PET	109	109	109	105	109	126	126
HDPE				3,603	3,603	1,569	1,569
Other Plastic				359	359	0	0
Subtotal (Plastic)	109	109	109	4,067	4,071	1,695	1,695
Organics							
Food wastes	3,664	4,317	15,476	15,476	25,309	22,344	29,212
Yard waste	9,769	10,076	17,271	15,328	17,271	18,145	20,962
Subtotal (Organics)	13,433	14,393	32,746	30,803	42,580	40,489	50,174
Wood Waste	621	621	621	621	621	646	672
Construction/Demolition Waste	752	752	752	752	752	821	890
Disposable Diapers			0	0	0	0	0
Textiles/Leather/Rubber	1,639	1,639	1,639	1,639	1,639	2,053	2,053
Other	439	439	439	439	439	439	439
Subtotal (Wood - Other)	3,451	3,451	3,451	3,451	3,451	3,959	4,054
TOTAL	**38,581**	**39,541**	**68,711**	**78,878**	**90,658**	**89,357**	**111,267**
Higher Diversion Estimate =	**27%**	**28%**	**48%**	**56%**	**64%**	**63%**	**79%**

4.5 Residential System Diversion Estimates for Metropolitan Toronto

Diversion estimates for the six residential systems considered for Metropolitan Toronto are presented in Schedule J. The estimates have been developed using 1992 data for illustrative purposes. The range of diversion estimates presented in this section and used for comparative evaluation of systems is achievable in the year 2000, assuming that the system is fully operational by the year 2000. In all cases, an additional 5% is added to the high end of the range presented to account for source reduction achievable by the year 2000. Any unique Region-specific features of the estimates are discussed in this section.

4.5.1 Metro Existing System

Existing System Description

In 1992, residential recycling services in Region of Metropolitan Toronto consisted of the following components:

- residential curbside recycling services to 704,000 households
- igloos and domes in public areas
- 105,000 backyard composters
- 25 large 3-bin composting units for apartments and cooperative housing complexes
- Recycling service to approximately 65% of units in multi-family buildings
- 6 leaf and yard waste composting facilities operated by Metro or municipalities
- 3 MRFs processing container and fibres materials
- Goodwill Industries operates 10 "Attended Donation Centres," 20 stores for donating clothing and small items and a training facility for repairing mattresses, furniture, small engines.
- ReUze Center in Scarborough
- Second Harvest, a non profit organization that acts as a broker between sources of surplus perishable food and social service organizations that can use it
- ten permanent HHW depots - eight in Metro, one at the Keele Valley landfill and one at the Brock West Landfill, each operated for 2 days per week
- two Toxic Taxis operated 6 days per week to residents with a minimum of 10 l of HHW for disposal
- curbside collection of white goods in East York, Etobicoke and York
- drop-off depot for white goods in Etobicoke
- pilot wet collection program

- extensive advertising, education and promotion, including a general information hotline operated by Metro
- landfill bans on OCC, office paper, tires, drywall, scrap metal, surplus goods, off-specification goods, excavated material and wood.

An estimated 1,077,245 tonnes of residential waste were generated in Metropolitan Toronto in 1992. Of this, 208,632 tonnes were diverted and 868,613 tonnes disposed for an estimated residential waste diversion rate of 19.4%. Estimated residential waste diversion was made up of the following activities:

Blue Box curbside	99,671 tonnes
Dry Recyclables from depots	2,611 tonnes
Large appliances/scrap metal	9,413 tonnes
Leaf and yard waste	71,062 tonnes
Household wet waste through backyard composters	25,200 tonnes
Household Hazardous Waste	675 tonnes
Total diverted 1992	208,632 tonnes

This information is summarized in Table 4.5.

The following text describes residential waste diversion activities under a number of headings. Information for this section was obtained from a number of sources including:

- survey of regional and municipal staff, February-March 1993
- on-going discussions with regional and municipal staff, February-October, 1993
- Miscellaneous reports to council, internal memoranda, etc. which are referenced at the end of this chapter.

For ease of presentation, each value will not be referenced in the following text.

Residential Recycling and Collection

In 1992, Metro Toronto contained an estimated 872,162 households of which 288,275 were single-family dwellings, 314,385 were high-rise apartments and 269,502 were other households, including semi-row townhouses, low-rise apartments, mobile homes, etc. (Hardy Stevenson Associates, 1993).

Table 4.5

Summary of Existing Residential Waste Diversion System Performance
Metropolitan Toronto
1992

Regional Characteristics	
Regional Population	2,298,031
Total Number of Households	872,162
— single-family	288,275
— multi-family	314,385
— other	269,502
Households served by curbside	704,000
Number of backyard composters distributed	105,000
Residential Material Diverted in 1992	
Blue Box	99,671 tonnes
Depots (Blue Box materials)	2,611 tonnes
Other materials	10,088 tonnes
Leaf and yard waste collection and composting	71,062 tonnes
Diversion through backyard composters	25,200 tonnes
Total residential waste diverted	208,632 tonnes
Residential waste diversion summary	
Residential waste generated	1,077,245 tonnes
Residential waste diverted	208,632 tonnes
Residential waste disposed	868,613 tonnes
Residential waste diversion rate	19.4%

Sources: Hardy Stevenson Associates, 1993.
Regional and Municipal Staff, 1993.
Reports to Council.

In 1992, a reported 704,000 households in Metro Toronto were provided with curbside residential recycling collection. This total included an estimated 65% of all multi-family households in Metro (Pollock, Metro Toronto 1993). There were also a small number of IC&I commercial enterprises receiving collection, predominantly in the City of Toronto.

Area municipalities launched curbside Blue Box recycling programs between 1988 and 1989. All municipalities offer residents weekly curbside pickup, except the City of Toronto which operates a unique program that collects paper and container material on alternate weeks.

The following materials were collected from the Blue Box programs and depots operating in all of the municipalities in Metropolitan Toronto in 1992:

- ONP and OMG (commingled) – 57,995 tonnes;
- OCC – 2,786 tonnes;
- Telephone Directories – 1,098 tonnes;
- Glass – 23,789 tonnes;
- Steel (including scrap metal and white goods) – 18,314 tonnes;
- Aluminum – 387 tonnes;
- PET – 635 tonnes;
- HDPE – 1,141 tonnes;
- Metal, Wood, Tires, Textiles etc. - 6,225 tonnes

Curbside collection of recyclable materials in Metropolitan Toronto is operated by each municipality. The City of Toronto utilizes conventional garbage packers to collect recyclables. The container materials and fibres are set out by the householder on alternate weeks, and loaded directly into the back of a packer truck. These vehicles require two person crews to operate.

All other municipalities in Metro collect recyclable materials with compartmentalized recycling vehicles operated by one person. Recyclables collected from households in East York, York, and all apartment households served by curbside pick-up in Metropolitan Toronto are sorted into two compartments, one for fibres, the other for container materials. In contrast, recyclables collected in Scarborough, Etobicoke, and North York are sorted into the following four streams:

- ONP, OCC and OMG;
- clear glass;
- coloured glass;
- tinplate steel, aluminum cans and plastics.

Residential Household Composting

At the end of 1992, approximately 105,000 backyard composters had been distributed to Metro Toronto households. Based on an estimated diversion rate of 240 kg per unit, approximately 25,200 tonnes of organic waste was diverted from landfill in 1992 through the use of backyard composters

Composters are distributed to Metro residents at a charge of $10 per unit. They can be purchased at all Metro transfer stations, or, for an additional charge of $5, the unit can be delivered to the door. Composters are also available for sale at leaf and yard waste compost giveaway events, or at household hazardous waste collection drop-offs.

Promotional efforts include radio and newspaper advertisements, backyard composting manuals which have been published in many languages, displays and a telephone hotline. Metro also offers extensive educational support, including a master composter program, which is operated on Metro's behalf by the Recycling Council of Ontario.

In 1992, the total cost to purchase and distribute composters, administer and advertise the program was about $39.00 per unit. This cost takes into account any available Ministry funding. It does not include Master Composter program costs or information officers' salaries.

To address the composting needs of residents of multi-residential dwellings in the Metro Area, community composting activities are being promoted. Large 3-bin units are available to apartment and co-operative housing complexes for $150 each. By the end of 1992, 25 of these units were in use (Ferguson, 1993). The Recycling Council of Ontario is involved in a demonstration project on multi-family composting (RCO, 1993).

Metro Toronto recently conducted a study to determine the long term usage of backyard composting units. It was discovered that 98% of units distributed since 1989 are still in use (Ferguson, 1993).

Residential Leaf and Yard Waste Collection/Composting Facilities

In 1992, collection of leaf and yard waste in Metropolitan Toronto totaled 71,062 tonnes. Leaf and yard waste is processed in 6 centralized windrow composting facilities - the Keele Valley landfill site, three sites in North York, one in Etobicoke and one in Scarborough. Keele Valley is the largest and employed 17 people in 1992, although that number is expected to drop to nine or ten in 1993. The Keele Valley facility accepted waste from the cities of York and Toronto and the Borough of East York. Due to odour complaints and

other problems, however, North York and Etobicoke may divert leaf and yard waste from their facilities to the Keele Valley site in the future.

Other Residential Waste Diversion

Reuse Activities

A number of reuse activities are ongoing in Metropolitan Toronto. These include social service organizations involved in the reuse and repair of clothing, white goods, books, furniture and machinery, as well as an organization that is involved in promoting the diversion of edible food from disposal. Some of these activities include:

Salvation Army and Goodwill Industries provide drop-off containers and trailers for reusable clothing, appliances and furniture. Goodwill Industries operates 10 "Attended Donation Centers" and 20 stores for donating clothing and small items in the GTA. Their main headquarters are in Metro Toronto. Goodwill also operates a training centre for adults who face employment barriers. This centre runs a number of vocational training programs which encourage "reuse" such as: mattress refurbishing; small engines repair (i.e. snowmobiles, lawn mowers, etc.); and furniture repair. In 1992, Goodwill collected about 10,000 tonnes of material in the GTA.

Goodwill is interested in pursuing joint projects with municipalities interested in collecting textiles and household goods. An example of such a cooperative arrangement exists in Mississauga. Laidlaw Waste Systems is the City of Mississauga's recycling contractor. They provide textile collection through the Blue Box program to Goodwill Industries. Goodwill sorts the materials and prepares them for resale at their retail stores.

St. Vincent de Paul Society organizes textile collections through individual parishes of the Catholic Church;

The **ReUze Center in Scarborough** is privately operated. The centre was opened by two former renovators in April 1992. A grant of $237,000 was received from the MOEE (through the Industrial Waste Diversion Program).

The ReUze Center was modeled on similar operations in North America. (A similar salvage operation in Vermont is operating at a profit in their first year of operation). Items accepted and resold at the ReUze centre include cabinets, doors, electrical supplies, floor coverings, hardware, heating supplies, plumbing fixtures, windows and standard building materials such as drywall, lumber and plywood. The centre receives about 100 tons per month.. The average selling price for materials is about 75% less than if purchased new (Sawatsky, R, Reuze Centre, 1993).

Second Harvest is a Metro Toronto based non-profit organization that acts as a broker between sources of surplus, perishable food and social service organizations that can use it. This grassroots organization employs 8 people and operates on a $430,000 annual operations budget (most of the funding comes from corporations and foundations).

Second Harvest receives food from catered events, retailers, manufacturers, grocery stores, restaurants, hotels, hospitals, convention facilities, corporate cafeterias, bakeries, etc. Staff and volunteers locate, collect and deliver perishable food to various social service agencies within the GTA. The organization is currently working with Transport Canada and health authorities to collect surplus milk and other packaged food from Air Canada and Cara Foods. In 1992, Second Harvest diverted 500 tons of food to social service organizations (Heaton, 1993).

Goods Exchange Days: East York has organized goods exchange days. Quantification of diversion from goods exchange days is not carried out, but tonnages are expected to be relatively low.

Household Hazardous Waste (HHW) Program

Metro Toronto operates ten permanent HHW depots - eight in Metro, one at the Keele Valley landfill and one at the Brock West landfill. These depots are open two days a week and are available for Metro, Durham and York residents only. Material is stored until Laidlaw Environmental Services removes it for proper disposal.

Metro also operates two Toxic Taxis. The Toxic Taxi provides collection services six days per week to residents with a minimum of 10L of HHW requiring disposal. The HHW is then transported to the Dufferin depot for storage and later collected by Laidlaw for disposal.

The following wastes were collected at the HHW depots or through the Toxic Taxi in 1990 and 1991. The values include York and Durham HHW drop-off.

Waste Type	1990	1991
Hazardous Waste (tonnes)	430.2	702.0
Motor Oil (tonnes)	17.4	68.0
Car Batteries (tonnes)	63.6	105.8
Propane Tanks (tonnes)	1.9	7.1
Total (tonnes)	**513.2**	**882.9**

White Goods

East York, Etobicoke, and York offer residents curbside collection of white goods. Etobicoke also has a drop-off depot. White goods collection vehicles used by Etobicoke are equipped with CFC recovery systems. CFC's are recovered where possible and white goods are shredded and recycled.

Residential Promotion and Education

Metro Toronto has published a waste reduction guide called *Your Guide To Waste Reduction and Recycling in Metropolitan Toronto, Second Edition* (Metropolitan Toronto Works Department 1991). The guide is intended to help residents in reducing, reusing and recycling waste. Contents include: the locations of recycling depots, information on what to do with specific materials (household hazardous waste, furniture, grass clippings, etc.), and a listing of local charitable organizations and reuse centres.

Promotional videos, office paper recycling guides, educational kits, waste reduction and recycling plans, and markets directories, all developed by Metro Toronto, are available to encourage the IC&I sector to adopt responsible waste management practices.

Metro Toronto operates a general information hotline on waste reduction and provides funding support to Ontario Recycling Information Service which provides information over the phone and maintains a resource library. (Metro funding for this service has been withdrawn in 1993). In addition, the Recycling Council of Ontario started an anti-junk mail campaign, encouraging residents to choose not to have junk mail delivered.

Material Recycling Facilities (MRFs)

Metropolitan Toronto had three MRFs processing municipal recyclables in 1992; a private and a public facility - both in downtown Toronto, and a third facility in Downsview.

CRinc

The CRinc MRF on Commissioners Street began operation in May, 1992 to process only container materials (glass, plastics, cans, etc.). This facility, located on the site of the former Commissioners St. incinerator, is owned by Metro and operated under contract by CRinc. The building is 15,000 square feet in size.

In the last eight months of 1992, the MRF processed 22,000 tonnes of recyclables. Of this, approximately 10% was residue and non-recyclable

materials such as unmarketable glass, string, ceramics, etc. The facility operated 16 hours, 5 days per week with a daily staff of 30.

The annual design throughput capacity is 25,000 tonnes/year. The current operating throughput is 22,000 tonnes/year.

QUNO

The second facility is owned by QUNO (formerly Quebec and Ontario Paper), and has operated through contract with Metro to process residential recyclables since November, 1988. This facility is also located on Commissioners Street, and is approximately 10,000 square feet in size.

In 1992, the facility processed both fibres and container materials. QUNO operated 24 hours, 5 days per week, processing 37,740 tonnes of recyclables in 1992. Of this total, 6 to 7% was fibre residue, and 20% was commingled glass residue, due to transfer breakage. The facility operated at capacity in 1992, and had 21 processing staff and 1 administrative staff, for a total of 22 staff members. In April 1993, QUNO will cease processing Metro container materials, but will continue with fibre processing. After this date, containers previously processed at QUNO will be processed at the Commissioners Street CRinc facility.

Dufferin MRF

The third processing facility is situated at the Dufferin Transfer Station in Downsview. This facility is owned by Metropolitan Toronto and operated by QUNO. In 1992, there was 6 processing staff and 1 administrative staff, for a total of 7 staff members.

In 1992, the MRF processed approximately 18,870 tonnes of recyclables, of which 4 to 5% was residue. The MRF operated on a single 8 hour shift, 5 days per week, and was operating at capacity in 1992.

Diversion Achieved

In 1992, approximately 208,632 tonnes of residential waste were diverted from landfill. The residential diversion rate was therefore approximately 19.4%. Over the longer term (to the year 2000), the existing system could be expected to achieve 24% diversion of residential waste. This estimate assumes that source reduction will increase to 5% (measured against a 1992 baseline) by the year 2000.

4.5.2 Metro Existing/Committed System

Existing/Committed System Description

The existing/committed system for Metropolitan Toronto is considered to encompass all facilities committed in Metro's capital funding budgets for the years 1993 to 1997, and any policy commitments at the local, regional, provincial or federal level, which had been announced by the end of 1992.

A review of Metropolitan Toronto's 1992 Development Charges Study and the 1993 Capital and Operating Budgets and five year forecast for Waste Diversion indicated the following (Future Urban Research, 1993):

- $69,697,000 (land and facility) allocated in the capital budget for a Regional Composting Plant. Approximately $26,839,000 has been allocated in the years 1994 to 1997 with the remaining costs budgeted post 1997. The capacity of the plant will be 125,000 to 180,000 tonnes per year. Discussions with Metro officials indicate that construction is unlikely to proceed within the five year period.

- $34,310,000 (land and facility) allocated in the capital budget for Recycling Centre #3. Approximately $9,083,000 has been allocated in the years 1994 to 1997 with the majority of the cost budgeted post 1997. Discussions with Metro staff indicate that construction of this facility will not proceed.

- $22,420,000 (facility only) allocated in the capital budget for Recycling Centre #2. Approximately $3,600,000 has been allocated in the years 1994 to 1997 with the majority of the costs budgeted post 1997. Discussions with Metro staff indicate that there are no firm plans to construct this facility. Recycling Centre #2 may be required if Blue Box materials continue to be collected in a commingled state (City of Toronto, City of York, East York and all apartment materials are currently collected in a commingled state). The CRinc facility has adequate capacity for cans and plastics, but when glass is included (as in commingled programs) additional capacity is required.

- $4,281,000 allocated in the capital budget for a Recycling Depot. Approximately $1,031,000 has been allocated in 1993 with the majority of the costs budgeted in the years 1994 to 1996. The recycling depot may be located at the Dufferin Transfer Station site, and would be a bi-level facility where recyclables would be dropped into different bins (similar to a facility in Region of Waterloo). Construction of the depot depends on future TTC plans for the area.

- $1,158,000 has been allocated for equipment for the MRF on Commissioners St. Approximately $1,058,000 has been allocated in 1993.

- $507,000 allocated in the capital budget for a Household Hazardous Waste Depot. Approximately $330,000 has been allocated in 1993 with the remaining costs budgeted in the years 1994 and 1995.

- $180,000 allocated in the capital budget for additional market development, research and product testing associated with the Wet Collection and Processing Program. The total program cost was estimated to be $2,761,000. It should be noted that the program is winding down.

- $1,576,000 has been allocated, to start up of recycling collection for the remaining 35% of multi-family units not receiving recycling services. With $1,185,000 allocated in the 1993 capital budget. As of the end of 1992, it was estimated that 65% of all apartment units in Metro received recycling services. The total cost of the program was approximately $13,811,000 of which the majority has been allocated prior to 1993.

- $1,728,000 allocated in the 1993 capital budget in association with the sale and distribution of an estimated 15,000 to 20,000 Backyard Composters. The total cost of the program was approximately $8,260,000 of which the majority has been allocated prior to 1993.

- $124,000 allocated in the 1993 capital budget in association with Roll Off Containers for Banned Material. The total cost of the containers is approximately $365,000. The remaining cost ($241,000) is allocated in 1994.

- $147,000 allocated in the 1993 capital budget in association with the prototype vehicles for recyclables. The total cost of the vehicle was approximately $489,000 of which the majority has been allocated prior to 1993.

- $196,000 allocated in the 1993 capital budget in association with tire recycling. The total cost of the program was approximately $292,000 of which $96,000 has been allocated prior to 1993.

- $1,449,000 allocated in the years 1994 to 1997 for the purchase of equipment and construction of a special facility. The total cost of the program is approximately $3,770,000 of which $2,321,000 has been allocated post 1997.

Metro planned to expand the range of materials collected in curbside recycling programs at the time this study was carried out. At that time, it had been proposed that as of October 1993, fine paper, pizza boxes and "gable top" polycoat cartons would be added to programs in Metro. This was estimated to divert an additional 3,500 tonnes per year through the Blue Box program. However, the proposal was rejected prior to implementations.

There is a proposal to retrofit the Fairfield digester at the Dufferin Transfer Station (capacity 50 tonnes/day) to process source separated organic waste from the IC&I sector.

In summary, the existing/committed residential waste diversion system will include all of the components of the existing system, and the addition of the following components:

- potential construction of two new MRF's to process residential recyclable materials.
- potential construction of new residential recycling depot at landfill or transfer station where residents drive to the top of the loading facility and drop recyclables into different bins.
- additional materials (fine paper, pizza boxes and gable top polycoat cartons) to be added to the residential Blue Box programs. It is estimated by Metro staff that an additional 3,500 tonnes will be diverted.
- distribution of 15,000 to 20,000 additional backyard composters (an average of 17,500 additional composters was assumed for study purposes)
- construction of a central composting facility
- potential increase in quantities and types of materials recycled by the residential sector, if the proposed GPMC Product Stewardship model is implemented (this impact was not quantified).
- the Blue Box, leaf and yard waste collection programs, Christmas tree collection, household hazardous waste collection and drop-off, and white goods collection will divert an additional 18,180 tonnes/year (including the additional 3,500 tonnes of paper listed above). This increased diversion will be due primarily to increased participation and program awareness. However, there will be less igloos and depots, therefore diversion tonnages from these sources will decrease by approximately 660 tonnes/year. (Metropolitan Toronto Commissioner of Works, 1993).

Diversion Achieved

The existing/committed residential waste diversion system is estimated to divert 21 to 26% of the residential waste stream. Both estimates were developed assuming that an additional 3,500 tonnes of fibre material/year would be added to the Blue Box system (proposal has since been cancelled), an additional 14,680 tonnes would be diverted due to increased participation in the Blue Box program, leaf and yard waste collection programs, Christmas tree collection, household hazardous waste collection and drop-off, and white goods collection, and an additional 4,200 tonnes would be diverted through 17,500 backyard composters. Diversion through other facilities in the five year capital forecast was not estimated, as the status of these projects is uncertain at this time. The higher diversion estimate assumes that source reduction will increase to 5% (measured against a 1992 baseline), by the year 2000.

4.5.3 Metro Direct Cost System

The assumptions listed in the Direct Cost methodology section (Section 4.3.5) were used to develop diversion estimates for Metropolitan Toronto. The Direct Cost system builds on the existing/committed system. Diversion estimates for this system ranged from 33 - 42% for Metro Toronto (excluding source reduction). Both estimates assume that 80% of leaf and yard waste would be diverted by curbside collection and backyard composting. The lower estimate assumes that 25% of households using backyard composters would divert 240 kg/composter/year, and the remainder (55% of single-family households, 15% of other households) would divert 100 kg/composter/year. In addition, the lower rate assumes that multi-family households would divert existing Blue Box materials (ONP, OCC, telephone directories, glass, metals, HDPE and PET) at 30% of the Quinte capture rate.

The higher estimate (42%) assumes that all households using backyard composters would divert 240 kg/composter/year, and that multi-family households would divert existing Blue Box materials at the Quinte capture rate. Source reduction is not included in this estimate.

The 9% difference between the high and low estimates of diversion impacts of a direct cost system was the highest of all of the GTA Regions. This is due to the large proportion of multi-family households (36%) in Metro (Hardy Stevenson Associates, 1993). The low rate assumes that multi-family residents would divert Blue Box materials at 30% of the single-family rate, thus, the larger the number of multi-family residents, the greater the impact on the diversion sensitivity analysis.

4.5.4 Metro Expanded Blue Box System

The assumptions listed in the Expanded Blue Box methodology section (Section 4.3.6) apply to the analysis conducted for Metropolitan Toronto. The Expanded Blue Box system builds on the existing/committed system. Diversion estimates for this system ranged from 37 - 48% in Metro (excluding source reduction). The lower estimate assumes that 25% of households using backyard composters would divert 240 kg/composter/year, and the remainder (55% of single-family households, 15% of other households) would divert 100 kg/composter/year. In addition, the lower rate assumes that multi-family households would divert Expanded Blue Box materials at 30% of the Quinte capture rate.

The higher diversion rate (48%) assumes that all households using backyard composters would divert 240 kg/composter/year, and that multi-family households would divert Expanded Blue Box materials at the Quinte capture rates. Source reduction is not included in this estimate.

The 11% difference between the high and low estimates was the highest of all of the GTA Regions. This is due to the large proportion (36%) of multi-family households in Metro. The low diversion rate assumes that multi-family residents would divert Expanded Blue Box materials at 30% of the single-family rate, thus, the larger the number of multi-family residents, the greater the impact on the diversion sensitivity analysis.

4.5.5 Metro Wet/Dry System

The assumptions listed in the Wet/Dry methodology section (Section 4.3.7) were used to estimate the impacts of a three-stream wet/dry system on residential waste diversion in Metropolitan Toronto. The three-stream wet/dry system builds on the existing/committed system. Diversion estimates for this system ranged from 49 - 62% in Metro (excluding source reduction). Both the high and low diversion estimates assume that 80% of leaf and yard waste would be diverted through curbside collection and backyard composting. The lower estimate assumes that multi-family households would divert 30% of their food waste through wet collection, and "single-family plus other" households would divert 80% of their wet waste through wet curbside collection plus backyard composting. In addition, the lower rate assumes that multi-family households would divert Expanded Blue Box materials at 30% of the Quinte capture rate.

The higher diversion rate (62%) assumes that all households would divert 80% of their food waste. "Single-family plus other" households would divert their food waste through wet curbside collection and backyard composting; multi-family households would divert their food waste through wet

collection. In addition, multi-family households would divert Expanded Blue Box materials at the Quinte capture rates. Source reduction is not included in this estimate.

The 13% difference between the high and low rates of diversion was the highest of all of the GTA Regions. This is due to the large number of multi-family households (36%) in Metro. The low diversion estimate assumes that multi-family residents would divert Expanded Blue Box materials at 30% of the single-family rate, thus, the larger the number of multi-family residents, the greater the impact on the diversion sensitivity analysis.

4.5.6 Metro Mixed Waste Processing System

The assumptions listed in the Mixed Waste Processing methodology section (Section 4.3.8) were used to estimate the impacts of this system on residential waste diversion in Metropolitan Toronto. The Mixed Waste Processing system builds on the existing/committed system. Diversion estimates for this system ranged from 54-55% (for compost landfilled) and up to 74% (for compost marketed) in Metro (excluding source reduction). The lower estimates assume that 25% of households using backyard composters would divert 240 kg/composter/year, and the remainder (55% of single-family households, 15% of other households) would divert 100 kg/composter/year. The higher estimates assume that all households using backyard composters would divert 240 kg/composter/year.

4.5.7 Metropolitan Toronto Summary

The detailed waste composition calculations for Metropolitan Toronto for each of the six systems discussed above are shown in Schedule J. Included for each system are two sets of analyses: a base case or low diversion estimate, with low backyard composter and multi-family dry recyclables diversion (as discussed above), and a sensitivity analysis with higher backyard composter and multi-family dry recyclables diversion. Tables 4.6 and 4.7 summarize the detailed diversion estimates for each of the two sets of analyses.

4.6 Residential System Diversion Estimates of Region of York

Diversion estimates for the six residential systems considered for Region of York are presented in Schedule K. The estimates have been developed using 1992 data for illustrative purposes. The range of diversion estimates presented in this section and used for comparative evaluation of systems is achievable in the year 2000, assuming that the system is fully operational by the year 2000. In all cases, an additional 5% is added to the high end of the range presented, to account for source reduction achievable by the year 2000.

Table 4.6

Residential System Diversion Estimates (Base Case)
Metropolitan Toronto

Component	Existing System Diversion (tonnes)	Existing/ Committed Diversion (tonnes)	Direct Cost System Diversion (tonnes)	Expanded Blue Box Diversion (tonnes)	Wet/Dry System Diversion (tonnes)	MSW (compost landfilled) (tonnes)	MSW (compost marketed) (tonnes)
Total Residential Waste (tonnes)	208,632	230,350	357,272	400,633	524,557	579,038	792,654
Paper							
Newspaper	57,995	63,951	116,003	116,003	116,003	138,370	175,423
Corrugated cardboard (OCC)	2,786	3,039	13,768	13,768	13,768	21,591	27,124
Telephone Directories	1,098	1,212	1,799	1,799	1,799	2,604	3,019
Mixed paper		3,500	3,500	48,483	48,483	85,430	150,380
Subtotal (Paper)	61,879	71,702	135,070	180,053	180,053	247,995	355,947
Glass	23,789	26,183	31,241	31,241	31,241	32,176	32,176
Tinplate Steel (ferrous)	18,314	19,787	24,073	24,073	24,073	34,115	34,115
Aluminum (non-ferrous)	387	415	6,730	6,730	6,730	5,722	5,722
Plastic							
PET	635	697	625	625	625	1,003	1,003
HDPE	1,141	1,252	21,491	21,491	21,491	13,472	13,472
Other Plastic		0	0	2,142	2,142	0	0
Subtotal (Plastic)	1,776	1,949	22,116	24,258	24,258	14,475	14,475
Organics							
Food wastes	17,136	19,992	36,288	36,288	156,447	128,251	220,214
Yard waste	79,126	84,208	95,641	91,877	95,641	104,330	116,784
Subtotal (Organics)	96,262	104,200	131,928	128,164	252,088	232,581	336,998
Wood Waste		0	0			451	902
Construction/Demolition Waste	1,500	1,122	1,122	1,122	1,122	1,918	2,714
Disposable Diapers		0	0			0	0
Textiles/Leather/Rubber		0	0			4,612	4,612
Other	4,725	4,992	4,992	4,992	4,992	4,992	4,992
Subtotal (Wood - Other)	6,225	6,114	6,114	6,114	6,114	11,974	13,221
TOTAL	208,632	230,350	357,272	400,633	524,557	579,038	792,654
Low Diversion Estimate =	19%	21%	33%	37%	49%	54%	74%

Table 4.7

Residential System Diversion Estimates (Sensitivity Analysis)
Metropolitan Toronto

Component	Existing System Diversion (tonnes)	Existing/ Committed Diversion (tonnes)	Direct Cost System Diversion (tonnes)	Expanded Blue Box Diversion (tonnes)	Wet/Dry System Diversion (tonnes)	MSW (compost landfilled) (tonnes)	MSW (compost marketed) (tonnes)
Total Residential Waste (tonnes)	208,632	230,350	453,655	517,942	664,849	594,833	796,386
Paper							
Newspaper	57,995	63,951	155,325	155,325	155,325	138,370	175,423
Corrugated cardboard (OCC)	2,786	3,039	18,435	18,435	18,435	21,591	27,124
Telephone Directories	1,098	1,212	2,406	2,406	2,406	2,604	3,019
Mixed paper		3,500	3,500	64,919	64,919	85,430	150,380
Subtotal (Paper)	61,879	71,702	179,666	241,085	241,085	247,995	355,947
Glass	23,789	26,183	41,831	41,831	41,831	32,176	32,176
Tinplate Steel (ferrous)	18,314	19,787	31,399	31,399	31,399	34,115	34,115
Aluminum (non-ferrous)	387	415	9,011	9,011	9,011	5,722	5,722
Plastic							
PET	635	697	836	836	836	1,003	1,003
HDPE	1,141	1,252	28,777	28,777	28,777	13,472	13,472
Other Plastic		0	0	2,868	2,868	0	0
Subtotal (Plastic)	1,776	1,949	29,613	32,480	32,480	14,475	14,475
Organics							
Food wastes	17,136	19,992	55,230	55,230	202,137	139,143	223,056
Yard waste	79,126	84,208	100,791	100,791	100,791	109,233	117,675
Subtotal (Organics)	96,262	104,200	156,021	156,021	302,928	248,376	340,730
Wood Waste		0	0			451	902
Construction/Demolition Waste	1,500	1,122	1,122	1,122	1,122	1,918	2,714
Disposable Diapers		0	0			0	0
Textiles/Leather/Rubber		0	0			4,612	4,612
Other	4,725	4,992	4,992	4,992	4,992	4,992	4,992
Subtotal (Wood - Other)	6,225	6,114	6,114	6,114	6,114	11,974	13,221
TOTAL	**208,632**	**230,350**	**453,655**	**517,942**	**664,849**	**594,833**	**796,386**
Higher Diversion Estimate =	**19%**	**21%**	**42%**	**48%**	**62%**	**55%**	**74%**

Any unique Region-specific features of the estimates are discussed in this section.

4.6.1 Region of York Existing System

Existing System Description

The Region of York is the only regional government within the GTA which does not co-ordinate the recycling programs of its member municipalities. Each municipality is solely responsible for the implementation and operation of its own recycling programs.

In 1992, residential recycling services in Region of York consisted of the following components:

- 159,507 households were provided with curbside collection of Blue Box recyclables. All municipalities offered curbside collection.
- Markham collected materials from recycling depots - no figures on exact quantities are available. The depots accepted all Blue Box materials, plus boxboard, mixed paper, scrap metal and tires. Whitchurch-Stouffville was the only other municipality reporting any depot collection.
- 29,050 backyard composters were distributed
- extensive promotion and education programs
- one Regional leaf and yard waste composting site
- seasonal curbside collection of leaf and yard waste and drop-off at regional composting site
- periodic HHW collection days
- two mobile HHW depots
- periodic curbside collection of white goods
- drop-off depot for white goods collection at King Township landfill (for King residents)
- two MRFs, one owned by Markham and the other owned by Richmond Hill. Both are operated by Miller Waste Systems Ltd.

An estimated 198,313 tonnes of residential waste were generated in Region of York in 1992. Of this, 56,163 tonnes were diverted and 142,150 tonnes disposed for an estimated residential waste diversion rate of 28.3%. Estimated residential waste diversion was made up of the following activities:

Dry recyclables	25,433 tonnes
Other materials	7,458 tonnes
Leaf and yard waste	16,300 tonnes
Household wet waste through backyard composters	6,972 tonnes
Total diverted 1992	56,163 tonnes

This information is summarized in Table 4.8.

The following text describes residential waste diversion activities under a number of headings. The information presented was obtained from a number of sources including:

- survey of regional and municipal staff, February-March 1993

- on-going discussions with regional and municipal staff, February-July, 1993

- Miscellaneous reports to council, internal memoranda, etc. which are referenced at the end of this chapter.

For ease of presentation, each value will not be referenced in the following text.

Residential Recycling and Collection

In 1992, the Region of York contained an estimated 161,556 households. Of these, 128,061 were single-family households, 18,306 were high rise apartments and 15,189 were other households, including semi-row townhouses, duplexes, low-rise apartments, mobile homes, etc.

An estimated 159,507 single, multi-family and rural households in York were served with some form of recyclables collection in 1992. Each municipality within the Region is solely responsible for the implementation and operation of its own curbside recycling program.

The following tonnages of materials were collected from residential recycling programs in the Region in 1992:

- 16,641 tonnes of ONP and OMG (commingled);
- 677 tonnes of OCC;
- 75 tonnes of Telephone Directories;
- 69 tonnes of mixed paper;
- 91 tonnes of Aluminum;
- 2,796 of Tinplate Steel
- 5,770 tonnes of Glass;
- 282 tonnes of PET;
- 404 tonnes of HDPE;
- 6,087 tonnes of metal, wood, tires, textiles etc.

Table 4.8

Summary of Existing Residential Waste Diversion System Performance
Region of York
1992

Regional Characteristics	
Regional Population	522,248
Total Number of Households	161,556
— single-family	128,061
— multi-family	18,306
— other	15,189
Households served by curbside	159,507
Number of backyard composters distributed	29,050
Residential Material Diverted in 1992	
Blue Box	25,433 tonnes
Other Materials	7,458 tonnes
Leaf and yard waste collection and composting	16,300 tonnes
Diversion through backyard composters	6,972 tonnes
Total residential waste diverted	56,163 tonnes
Residential waste diversion summary	
Residential waste generated	198,313 tonnes
Residential waste diverted	56,163 tonnes
Residential waste disposed	142,150 tonnes
Residential waste diversion rate	28.3%

Sources: Hardy Stevenson Associates, 1993.
Regional and Municipal Staff, 1993.
Reports to Council.

Residential Household Composting

At the end of 1992, 29,050 backyard composting units had been distributed in the Region of York. It is estimated that 6,972 tonnes of organic material were diverted through this program in 1992, assuming a diversion rate of 240 kg/composter/year.

Backyard composting is the responsibility of the lower tier municipalities, although the Region helped with some promotion. Most of the municipalities charged a fee equivalent to one third the cost of the unit plus an administration charge for distribution of backyard composters to residents. In addition to regular municipal distribution, composters were sold at three retail outlets. Richmond Hill and Markham hired students to conduct a door-to-door promotion and education, sales and delivery campaign. Each municipality supports its backyard composting program with a variety of promotional material, including flyers, brochures, calendars and educational seminars.

Residential Leaf and Yard Waste Collection/Composting Facilities

In 1992, collection of "green" waste in the Region of York totaled 16,300 tonnes. A central yard waste composting facility was opened by the Region in 1990. The facility also accepts grass clippings, shrubs, branches and garden plants from residents and commercial businesses. Residents deliver waste free, while commercial operators are charged $25 per tonne.

York Region contracted the provision and operation of the regional leaf and yard waste composting operation to Miller Waste Systems. The composting site is 12 acres in size. The surface of the pad is covered with wood chips laid over a sandy base. The facility began receiving material in the fall of 1990.

Almost all the equipment used on site is owned and maintained by the Region of York. Equipment includes a SCARRAB windrow turner, front end loader, chipper and a trommel screen. Staffing requirements vary according to the season. During the spring and fall, 6 to 8 employees are required, dropping to 3 people in non-peak months.

The contractor assumes responsibility for marketing of the finished compost, although 75% of any revenue received must be returned to the Region. In 1991, finished material was given away to the public. Local municipalities were charged $10/tonne to use the material in 1991. At the end of 1992, a significant amount of finished compost was being stockpiled at the site.

Other Residential Waste Diversion

Reuse Activities

No residential reuse centres (other than social service organizations discussed in the Metro Toronto section) currently operate in the Region of York. Richmond Hill conducts goods exchange days.

Household Hazardous Waste (HHW) Program

In York Region, periodic HHW collection days have been conducted in Aurora, Newmarket, East Gwillimbury, Bradford, Richmond Hill, Newmarket, and Whitchurch-Stouffville. Wastes collected at these events were managed by Laidlaw.

In 1992, Richmond Hill collected approximately 252 batteries and 28 tonnes of HHW with a mobile HHW depot. The Region of York also ran a successful pilot mobile HHW depot in 1992.

White Goods

All area municipalities provide some curbside collection to residents (once week, per month or per year) for white goods. Only King Township reported operating a drop-off service at its landfill.

Richmond Hill now reclaims CFC and compressor oil and sends units for shredding and recycling. Approximately 54 tonnes of white goods were collected by Markham in 1992. Quantities collected by other municipalities were not available.

Residential Promotion and Education

Only HHW and yard waste programs are promoted at the Regional level. Other programs are left to the municipalities. The municipalities conduct extensive promotion through advertising, brochures, hotline phone service and information flyers. Richmond Hill and Markham conducted extensive door to door sales campaigns for composters with assistance from students. Markham also conducted a number of seminars for the general public and schools.

Public Sector Material Recovery Facilities (MRFs)

Recyclables from all nine area municipalities in York Region are processed at one of two MRFs; one in the Town of Markham and the other in the Town of Richmond Hill.

Markham MRF

The Markham MRF is owned by Markham and operated by Miller Waste Systems Ltd. It services recyclables from Markham, Aurora, King and Vaughan. The MRF began operation in 1988 as a temporary processing facility, and has been operating on this basis since that time.

In 1992, approximately 15,855 tonnes of recyclables, including newspapers and container materials, were processed. The facility operated 9.5 hours per day, 5 days per week with 4 staff. Residue quantities were less than 1%, since most of the recyclables sorting and contaminant control is done during collection.

The Region is currently in the process of establishing a larger, regional processing facility located in Markham to service all area municipalities.

Richmond Hill MRF

This MRF is located in Richmond Hill, owned by the Town, and also operated by Miller Waste Systems Ltd. It serves Richmond Hill, Newmarket, East Gwillimbury and Whitchurch Stouffville.

The facility operates 9.5 hours per day, 5 days per week and in 1992, processed about 8,377 tonnes (excluding East Gwillimbury) of residential recyclables from within the Region, with a daily staff of 2-3. Residue averaged less than 1% of total throughput tonnage.

Processing costs for the Richmond Hill MRF for 1992 were reported to be $502,744. This MRF will be replaced by a larger, regional MRF in 1993.

Georgina collected about 1,200 tonnes of Blue Box materials that were sent outside the Region for sorting and further processing.

Diversion Achieved

In 1992, approximately 56,163 tonnes of residential waste were diverted from landfill. The residential diversion rate was therefore approximately 28%. Over the longer term (to the year 2000), the existing system could be expected to achieve 33% diversion of residential waste. This estimate assumes that source reduction will increase to 5% (measured against a 1992 baseline), by the year 2000.

4.6.2 Region of York Existing/Committed System

Existing/Committed System Description

The existing/committed system for York is considered to encompass all facilities committed in the Region's capital funding budgets for the years 1993 to 1997, and any policy commitments at the local, regional, provincial or federal level, which had been announced by the end of 1992.

A review of the Region of York's 1992 Development Charges Study and the 1993 Capital and Operating Budgets and five year forecast for Waste Diversion indicated the following (Future Urban Research, 1993):

- $2,224,000 has been allocated in the budget for a Regional MRF. The existing municipal facilities will terminate operations when the Regional facility commences operations;
- $445,100 has been allocated in the budget to cover increased payments to contractors as a result of an increase in the service level in the Household Hazardous Waste Program;
- $116,000 has been allocated in the budget to cover an increase in the service level of the Organic Yard Waste operations.

No expansion in the range of materials collected in curbside recycling programs is planned at the Regional level. The Region is planning to establish a new Regional MRF to replace the existing two facilities and to increase the levels of service in the HHW program and leaf and yard waste composting operations. Individual municipalities will also be distributing additional backyard composters to residents - exact numbers are not known, however. Canada Composting Inc. has plans to construct a $20 million large scale centralized waste conversion facility in Newmarket. When (if) built, it will be the first anaerobic system of its kind in North America. It uses a patented anaerobic digestion technology to break down organic waste in five days. The process will produce methane and potentially provide input to a congeneration facility (Resource Recycling, 1993). If constructed the facility will accept up to 7,000 tonnes of organic residential waste from Newmarket when operating in 1994. The town is examining details for a wet/dry collection system to supply this facility.

The Town of Markham is planning to operate a demonstration wet/dry (3-stream) project in Unionville, starting late in 1993. The project will involve approximately 2,500 households, and will demonstrate the potential for using a new truck design. Some delays have been experienced in the project because of uncertainty regarding the composting site to be used for wet waste processing.

Implementation of the 3Rs Regulations under the Environmental Protection Act (EPA) will not impact residential waste diversion practices by municipalities within the Region of York, as all municipalities meet the requirements of the proposed regulations for residential waste management. Under the new regulations, municipalities of greater than 50,000 must provide curbside collection of leaf and yard waste. It is unclear if existing leaf and yard waste management practices within the Region meet the requirements of the regulations. However, increased leaf and yard waste collection efforts are being considered at this time. Regulations requiring owners of buildings containing 6 or more apartments to provide recycling to residents will not have a major impact in Region of York, because the majority of households are single family and only a minor proportion of the housing stock (11%) is in multi-family housing.

In summary, the existing/committed residential waste diversion system will include all of the components of the existing system, and the addition of the following components:

- construction of a new Regional MRF that will replace the existing two MRFs in the Region;
- additional materials will not be added to the residential Blue Box programs;
- distribution of additional backyard composters (number is not known at this time);
- an increase in the level of service in both the HHW and leaf and yard waste programs;
- construction of a privately owned and operated in-vessel composting facility in the Newmarket area. The facility will process waste primarily from the IC&I sector but will accept up to 7,000 tonnes per year of residential waste from Newmarket (because of the uncertainty regarding this facility, it may be excluded from the analysis);

In the Region of York, there were no funding commitments which translated into additional diversion tonnages. Therefore, the existing and existing/committed systems are identical.

Diversion Achieved

The existing/committed residential waste diversion system is estimated to divert 28 to 33% of the residential waste stream. The higher estimate assumes that source reduction will increase to 5% (measured against a 1992 baseline), by the year 2000. The lower estimate assumes no source reduction of residential waste, and is equivalent to the diversion achieved by the existing system.

4.6.3 Region of York Direct Cost System

The assumptions listed in the Direct Cost methodology section (Section 4.3.5) apply to the diversion impact analysis conducted for the Region of York. The Direct Cost system builds on the existing/committed system. Diversion estimates for this system ranged from 44 - 50% in Region of York (excluding source reduction). Both estimates assume that 80% of leaf and yard waste would be diverted by curbside collection and backyard composting. The lower estimate assumes that 25% of households using backyard composters would divert 240 kg/composter/year, and the remainder (55% of single-family households, 15% of other households) would divert 100 kg/composter/year. In addition, the lower rate assumes that multi-family households divert existing Blue Box materials (these vary from municipality to municipality, however, the base materials are ONP, OCC, telephone directories, glass, metals, HDPE and PET) at 30% of the Quinte capture rate.

The higher estimate (50%) assumes that all households using backyard composters would divert 240 kg/composter/year, and that multi-family households would divert existing Blue Box materials at the Quinte capture rates. Source reduction is not included in this estimate.

The 6% difference between the high and low rates of diversion was the second lowest of all of the GTA Regions. This is due to the relatively low proportion (11%) of multi-family households in York.

4.6.4 Region of York Expanded Blue Box System

The assumptions listed in the Expanded Blue Box methodology section (Section 4.3.6) apply to the diversion impact analysis conducted for the Region of York. The Expanded Blue Box system builds on the existing/committed system. Diversion estimates for this system ranged from 49 - 56% in Region of York (excluding source reduction). The lower estimate assumes that 25% of households using backyard composters would divert 240 kg/composter/year, and the remainder (55% of single-family households, 15% of other households) would divert 100 kg/composter/year. In addition, the lower rate assumes that multi-family households would divert Expanded Blue Box materials at 30% of the Quinte capture rate.

The higher diversion rate (56%) assumes that all households using backyard composters would divert 240 kg/composter/year, and that multi-family households would divert Expanded Blue Box materials at the Quinte capture rates. Source reduction is not included in this estimate.

The 7% difference between the high and low rates of diversion was the lowest of all of the GTA Regions. This is due to the relatively low proportion (11%) of multi-family households in Region of York. The low diversion estimate assumes that multi-family residents would divert Expanded Blue Box materials at 30% of the single-family rate, thus, the larger the number of multi-family residents, the greater the impact on the diversion sensitivity analysis.

4.6.5 Region of York Wet/Dry System

The assumptions listed in the Wet/Dry methodology section (Section 4.3.7) apply to the diversion impact analysis for a three-stream wet/dry system conducted for the Region of York. The three-stream Wet/Dry system builds on the existing/committed system. Diversion estimates for this system ranged from 61 - 65% in Region of York (excluding source reduction). Both the high and low diversion estimates assume that 80% of leaf and yard waste would be diverted through curbside collection and backyard composting. The lower estimate assumes that multi-family households would divert 30% of their food waste through wet collection, and single-family plus other households would divert 80% of their wet waste through wet curbside collection plus backyard composting. In addition, the lower rate assumes that multi-family households would divert Expanded Blue Box materials at 30% of the Quinte capture rate.

The higher diversion rate (65%) assumes that all households would divert 80% of their food waste. "Single-family plus other" households would divert their food waste through wet curbside collection and backyard composting; multi-family households would divert their food waste through separate wet waste collection. In addition, multi-family households would divert Expanded Blue Box materials at the Quinte capture rates. Source reduction is not included in this estimate.

The 4% difference between the high and low rates of diversion was the second lowest of all of the GTA Regions. This is due to the relatively small proportion (11%) of multi-family households in Region of York. The low diversion estimate assumes that multi-family residents would divert Expanded Blue Box materials at 30% of the single-family rate, thus, the larger the number of multi-family residents, the greater the impact on the diversion sensitivity analysis.

4.6.6 Region of York Mixed Waste Processing System

The assumptions listed in the Mixed Waste Processing methodology section (Section 4.3.8) apply to the diversion impact analysis conducted for the Region of York. The Mixed Waste Processing system builds on the

existing/committed system. Diversion estimates for this system ranged from 60-63% (for compost landfilled) up to 79% (for compost marketed) in Region of York (excluding source reduction). The lower estimates assume that 25% of households using backyard composters would divert 240 kg/composter/year, and the remainder (55% of single-family households, 15% of other households) would divert 100 kg/composter/year. The higher estimates assume that all households using backyard composters would divert 240 kg/composter/year.

4.6.7 Region of York Summary

The detailed waste composition calculations for Region of York for each of the six systems discussed above are shown in Schedule K. Included for each system are two sets of analyses: a base case or low diversion estimate, with low backyard composter and multi-family dry recyclables diversion (as discussed above), and a sensitivity analysis with higher backyard composter and multi-family dry recyclables diversion. Tables 4.9 and 4.10 summarize the detailed diversion estimates for each of the two sets of analyses.

4.7 Residential System Diversion Estimates for Region of Peel

Diversion estimates for the six residential systems considered for Region of Peel are presented in Schedule L. The estimates have been developed using 1992 data for illustrative purposes. The range of diversion estimates presented in this section and used for comparative evaluation of systems is achievable in the year 2000, assuming that the system is fully operational by the year 2000. In all cases, an additional 5% is added to the high end of the range presented to account for source reduction achievable by the year 2000. Any unique Region-specific features of the estimates are discussed in this section.

4.7.1 Region of Peel Existing System

Existing System Description

In 1992, residential recycling services in Region of Peel consisted of the following components:

- residential curbside recycling services to 228,300 households
- drop-off depots at Britannia Road landfill
- 56,840 backyard composters
- leaf and yard waste composting site in Brampton
- composting area at Britannia Road landfill site
- compost demonstration site for pilot wet/dry projects
- compost area at Caledon landfill

Table 4.9

Residential System Diversion Estimates (Base Case)
Region of York

Component	Existing System Diversion (tonnes)	Existing/ Committed Diversion (tonnes)	Direct Cost System Diversion (tonnes)	Expanded Blue Box Diversion (tonnes)	Wet/Dry System Diversion (tonnes)	MSW (compost landfilled) (tonnes)	MSW (compost marketed) (tonnes)
Total Residential Waste (tonnes)	56,163	56,163	87,247	96,187	120,529	119,111	154,911
Paper							
Newspaper	16,641	16,641	25,201	25,201	25,201	26,554	31,490
Corrugated cardboard (OCC)	677	677	2,991	2,991	2,991	3,847	4,793
Telephone Directories	75	75	256	256	256	283	345
Mixed paper	69	69	69	10,599	10,599	14,870	26,603
Subtotal (Paper)	17,462	17,462	28,518	39,048	39,048	45,554	63,231
Glass	5,770	5,770	6,787	6,787	6,787	6,595	6,595
Tinplate Steel (ferrous)	2,796	2,796	5,298	5,298	5,298	5,958	5,958
Aluminum (non-ferrous)	91	91	1,462	1,462	1,462	1,018	1,018
Plastic							
PET	282	282	231	231	231	291	291
HDPE	404	404	4,669	4,669	4,669	2,513	2,513
Other Plastic				440	440	0	0
Subtotal (Plastic)	686	686	4,900	5,340	5,340	2,803	2,803
Organics							
Food wastes	4,741	4,741	10,789	10,789	33,101	25,135	39,482
Yard waste	18,531	18,531	23,407	21,377	23,407	24,924	28,471
Subtotal (Organics)	23,272	23,272	34,196	32,166	56,508	50,059	67,953
Wood Waste			0	0		80	159
Construction/Demolition Waste			0	0		150	301
Disposable Diapers			0	0		0	0
Textiles/Leather/Rubber	61	61	61	61	61	868	868
Other	6,025	6,025	6,025	6,025	6,025	6,025	6,025
Subtotal (Wood - Other)	6,087	6,087	6,087	6,087	6,087	7,123	7,353
TOTAL	56,163	56,163	87,247	96,187	120,529	119,111	154,911
Low Diversion Estimate =	28%	28%	44%	49%	61%	60%	78%

Table 4.10

Residential System Diversion Estimates (Base Case)
Region of York

Component	Existing System Diversion (tonnes)	Existing/ Committed Diversion (tonnes)	Direct Cost System Diversion (tonnes)	Expanded Blue Box Diversion (tonnes)	Wet/Dry System Diversion (tonnes)	MSW (compost landfilled) (tonnes)	MSW (compost marketed) (tonnes)
Total Residential Waste (tonnes)	56,163	56,163	99,396	111,325	129,250	124,883	156,275
Paper							
Newspaper	16,641	16,641	27,383	27,383	27,383	26,554	31,490
Corrugated cardboard (OCC)	677	677	3,250	3,250	3,250	3,847	4,793
Telephone Directories	75	75	279	279	279	283	345
Mixed paper	69	69	69	11,517	11,517	14,870	26,603
Subtotal (Paper)	17,462	17,462	30,981	42,429	42,429	45,554	63,231
Glass	5,770	5,770	7,375	7,375	7,375	6,595	6,595
Tinplate Steel (ferrous)	2,796	2,796	5,704	5,704	5,704	5,958	5,958
Aluminum (non-ferrous)	91	91	1,589	1,589	1,589	1,018	1,018
Plastic							
PET	282	282	242	242	242	291	291
HDPE	404	404	5,073	5,073	5,073	2,513	2,513
Other Plastic				480	480	0	0
Subtotal (Plastic)	686	686	5,316	5,796	5,796	2,803	2,803
Organics							
Food wastes	4,741	4,741	17,711	17,711	35,636	29,116	40,520
Yard waste	18,531	18,531	24,635	24,635	24,635	26,716	28,797
Subtotal (Organics)	23,272	23,272	42,346	42,346	60,271	55,831	69,317
Wood Waste						80	159
Construction/Demolition Waste						150	301
Disposable Diapers						0	0
Textiles/Leather/Rubber	61	61	61	61	61	868	868
Other	6,025	6,025	6,025	6,025	6,025	6,025	6,025
Subtotal (Wood - Other)	6,087	6,087	6,087	6,087	6,087	7,123	7,353
TOTAL	**56,163**	**56,163**	**99,396**	**111,325**	**129,250**	**124,883**	**156,275**
Higher Diversion Estimate =	**28%**	**28%**	**50%**	**56%**	**65%**	**63%**	**79%**

- a Regional salvage centre in Caledon
- Albion Reusable Goods Exchange
- Williams Parkway Reusable Goods Exchange in Brampton
- one permanent household hazardous waste depot at the Britannia Road landfill
- once-a-year HHW collection at Bolton Community Centre
- HHW depot located in City of Brampton
- drop-off depot for white goods in Caledon
- curbside pick-up of white goods in Brampton and Mississauga
- extensive promotion and education program
- MRF/transfer station in Bolton for Caledon material
- Recyclable material processing at the Laidlaw MRF in Mississauga for Mississauga and Brampton material

In 1992, an estimated 317,331 tonnes of residential waste were generated in Peel. Of this, 64,002 tonnes were diverted and 253,329 tonnes disposed for an estimated residential waste diversion rate of 20.2%. Estimated residential waste diversion was made up of the following activities:

Blue Box curbside	34,867 tonnes
Dry Recyclables from depots	5,793 tonnes
Other Dry Recyclables diverted	1,375 tonnes
Leaf and yard waste	7,661 tonnes
Household wet waste through backyard composters	13,641 tonnes
Household Hazardous Waste	665 tonnes
Total diverted 1992	64,002 tonnes

This information is summarized in Table 4.11.

The following text describes residential waste diversion activities under a number of headings. Information presented was obtained from a number of sources including:

- survey of regional and municipal staff, February-March 1993
- on-going discussions with regional and municipal staff, February-October, 1993
- miscellaneous reports to council, internal memoranda, etc. which are referenced at the end of this chapter.

For ease of presentation, each value will not be referenced in the following text.

Table 4.11

Summary of Existing Residential Waste Diversion System Performance
Region of Peel
1992

Regional Characteristics	
Regional Population	763,000
Total Number of Households	240,228
— single-family	118,927
— multi-family	64,439
— other	56,862
Households served by curbside	228,300
Number of backyard composters distributed	56,839
Residential Material Diverted in 1992	
Blue Box	34,867 tonnes
Depots (Blue Box materials)	5,793 tonnes
Depots (other materials)	2,040 tonnes
Leaf and yard waste collection and composting	7,661 tonnes
Diversion through backyard composters	13,641 tonnes
Total residential waste diverted	64,002 tonnes
Residential waste diversion summary	
Residential waste generated	317,331 tonnes
Residential waste diverted	64,002 tonnes
Residential waste disposed	253,329 tonnes
Residential waste diversion rate	20.2%

Sources: Hardy Stevenson Associates, 1993.
Regional and Municipal Staff, 1993
Reports to Council.

Residential Recycling and Collection

In 1992, the Region of Peel contained an estimated 240,228 households. Of these, 118,927 were single-family households, 64,439 were high rise apartments and 56,862 were other households, including semi-row townhouses, low-rise apartments, mobile homes etc. There were 763,000 residents in the Region in 1992 (Hardy Stevenson Associates, 1993).

An estimated 228,300 single, multi-family and rural households in Peel were served with some form of recyclables collection in 1992. Each municipality in Peel Region administers its own Blue Box program, which results in the collection of different recyclable materials in each municipality. The average weekly participation rate for the Blue Box program has been estimated at 75-80%.

The Region of Peel operates a drop-off recycling depot at the Britannia Landfill Site. Materials collected include all residential recyclables, ferrous metal, wood waste, drywall, all paper and plastic grades, and any other materials which have been banned. A total of 5,793 tonnes of recyclable materials were collected through drop-off depots in 1992. A total of 40,660 tonnes of dry recyclables were collected from both the residential curbside and depot recycling collection programs.

The following tonnages of materials were collected from residential Blue Box programs and drop-off depots in the Region:

- 21,534 tonnes of ONP and OMG (commingled);
- 1,234 tonnes of OCC;
- 712 tonnes of Telephone Directories;
- 469 tonnes of mixed paper;
- 6,137 tonnes of Aluminum and Steel (commingled);
- 6,674 tonnes of Glass;
- 694 tonnes of plastic;
- 3,206 tonnes of metal, wood, tires, textiles, etc.

Residential Household Composting

At the end of 1992, 56,839 backyard composting units had been distributed by the Region of Peel. In 1992 the program was updated to allow for the sale of subsidized backyard composters through established retail operations. It is estimated that 13,641 tonnes of organic material were diverted through this program in 1992, assuming a diversion rate of 240 kg/composter/year measured in a pilot project in Region of Durham.

Staffing to administer the backyard composting program consists of approximately 60% of a coordinator's time. Two summer students also provide assistance.

The Region's promotional budget for backyard composting is slightly more than $0.20 for each single-family household. In 1992 a brochure was published and distributed to about 185,000 non-apartment households. Newspaper advertisements have been utilized and a hotline is available for composting information.

Residential Leaf and Yard Waste Collection/Composting Facilities

Curbside collection of leaf and yard waste is limited in Region of Peel. The City of Brampton collects leaves only in the fall, and some leaf and yard waste collection occurs in the urban areas of Caledon. The City of Mississauga carries out very little management of leaf and yard waste. In 1992, curbside collection of leaf and yard waste in Peel totaled 7,661 tonnes. Leaf and yard waste is processed in 3 centralized windrow composting facilities; one in Brampton, one at the Britannia Road landfill and one at the Caledon landfill. In 1992, the Region conducted an experiment at the Britannia Road landfill. Instead of composting, the leaves were mixed in with topsoil. Equipment used on-site includes front end loaders, SCAT machines, a tub grinder and a trommel screen. The maximum staffing at any of the sites is 2 people.

Other Residential Waste Diversion

Reuse Activities

The Region of Peel operates a salvage centre in Caledon that accepts old furniture, appliances and any non-hazardous material. Residents are encouraged to bring goods and to take items home with them free of charge. The centre includes a textile drop-off box for Goodwill. Approximately 3,500 items were brought to the site in 1992, of which 86% were reused by residents. Municipal officials estimate that the salvage centre diverted approximately 75 tons of material from landfill in 1992 (Chubb, 1993).

There are two additional re-use centres operating in the Region, including:

- the **Albion Reusable Goods Exchange** which diverted approximately 194 tons of waste in 1992;
- the **Williams Parkway Reusable Goods Exchange** in Brampton which diverted over 31 tons of waste in 1992 (Stewart, 1993).

Household Hazardous Waste (HHW) Program

The Region operates one large permanent HHW depot at the Britannia landfill and a once-a-year HHW collection at the Bolton Community Centre. A third HHW collection site in Albion closed in 1992 pending full MOEE approval.

In addition to the Regional facilities, an HHW depot is located in the City of Brampton. The depots are operated on behalf of the Region of Peel and member municipalities by Laidlaw Environmental Services.

The following wastes were collected at the depots or on waste collection days:

- 385 tonnes of Household Hazardous Waste ;
- 2,240 Propane Tank units;
- 168 tonnes of Motor Oil ;
- 7,258 Car Battery units.

White Goods

Caledon provides a drop-off depot for white goods. Weights of material diverted were not available. Brampton offers daily white goods pickup as well as a drop-off depot. This led to diversion of 381 tonnes (215 tones scrap metal/166 tonnes reuse) in 1992. Mississauga offers curbside pick-up of white goods, capturing approximately 507 tonnes in 1992.

Collection vehicles used by Brampton and Mississauga are equipped for curbside CFC extraction and the recovered CFC's are sold to DuPont. Brampton also removes and recycles compressor oil.

Residential Promotion and Education

In 1992, a brochure about backyard composting was published and distributed to about 185,000 non-apartment households. Newspaper advertisements have been utilized, and a hotline is available for composting information. The Region also runs an extensive IC&I waste reduction campaign.

Public Sector Material Recycling Facilities (MRFs)

One public sector MRF/transfer station is operated in Bolton for Caledon. It operates 8 hours/day, 2 days per week, for a total of 832 operating hours per year. Its current annual throughput is 2,087 tonnes. Materials accepted include ONP, PET, glass, aluminum and steel cans. Materials are inventoried and sold directly to brokers. The facility reports an approximate 1% residue rate. The facility is operated by a total of 2 staff (Moffat, March 1993).

Laidlaw operates a large MRF in Mississauga, which processes all the material collected from the municipal curbside and apartment recycling programs in Mississauga and Brampton, in addition to materials from the IC&I sector. The Laidlaw MRF in Mississauga began operation in 1986. This facility processes fibre (ONP, OCC, OMG and telephone directories), container materials (glass, plastics, cans, etc.), and textiles. The building is 22,500 square feet in size.

In 1992, the MRF processed 23,172 tonnes of residential recyclables. Of this, approximately 5% was residue and non-recyclable materials. The facility operated 16 hours, 5 days per week with a staff of 8 per shift.

The annual design throughput capacity is 33,000 tonnes/year, and the facility was reported to be operating at capacity (with processing of IC&I in addition to residential recyclables).

Diversion Achieved

In 1992, approximately 64,002 tonnes of residential waste were diverted from landfill. The residential diversion rate was therefore approximately 20%. Over the longer term (to the year 2000), the existing system could be expected to achieve 25% diversion of residential waste. This estimate assumes that source reduction will increase by 5% (measured against a 1992 baseline), by the year 2000.

4.7.2 Region of Peel Existing/Committed System

Existing/Committed System Description

The existing/committed system for Peel is considered to encompass all facilities committed in the Region's capital funding budgets for the years 1993 to 1997, and any policy commitments at the local, regional, provincial or federal level, which had been announced by the end of 1992.

A review of Region of Peel's 1992 Development Charges Study and the 1993 Capital and Operating Budgets and five year forecast for Waste Diversion indicated the following (Future Urban Research, 1993):

- $500,000 has been allocated through 1997 for mini-recycling depots to service residents not serviced by existing programs.

- $10.5 million has been budgeted in 1993 for a new MRF to process residential recyclable materials from Blue Box collection,

community recycling centres and new mini-depots. An additional $14.5 million has been allocated for 1994 through 1997.

- $5 million has been allocated between 1994 and 1997 for the design and construction of a recycling centre that would accept recyclables, HHW, reusable items and residential waste. Satellite drop-off facilities are also included in this budget item.

- $10 million has been budgeted in 1993, with an additional $28.5 million budgeted in 1994 to 1997, to establish a central composting facility with a capacity of 69,000 tonnes per year in Peel which might be established in conjunction with Halton Region. (The above costs include $10 million for the purchase of up to 150,000 household bins for implementation of a wet/dry system).

The Region is not proposing to expand the range of materials collected in curbside recycling programs. It has, however, proposed establishing 7 new community recycling centres: 3 in Mississauga, 2 in Brampton and two in Caledon. It will also construct mini-recycling depots and satellite drop-off facilities for recycling. These will accept materials not currently collected in Blue Box programs such as plastics, mixed paper, and textiles and will also collect wood, clean fill, rubble and yard waste. The Region will also be distributing an additional 12,000 backyard composters to residents.

Based on an assumption that two of the new recycling facilities will be constructed in the next five year period (Williams, 1993), (Morgan-Fraser, 1993) - one urban and one rural - the anticipated additional diversion from these facilities is estimated at 10,800 tonnes per year. This consists of 9,600 tonnes of recyclables and 1,200 tonnes of household hazardous waste. The overall anticipated diversion from these facilities plus the additional backyard composters is 13,880 tonnes per year.

Implementation of the 3Rs Regulations under the Environmental Protection Act (EPA) will not impact recycling practices by municipalities within the Region, as all municipalities meet the requirements of the proposed regulations for recycling. Under the new regulations, municipalities of greater than 50,000 must provide curbside collection of leaf and yard waste. It is unclear if existing leaf and yard waste management practices within the Region meet the requirements of the regulations, as minimal leaf and yard waste management occurs in Mississauga. However, increased leaf and yard waste collection efforts are being considered at this time. Regulations requiring owners of buildings containing 6 or more apartments to provide recycling to residents will not have a major impact in Peel, because 70% of multi-family residents reportedly already participate in Blue Box programs (Williams, 1993).

Capital funding has been included and budgeted to construct a central composting facility in the Region (this may be shared with Region of Halton). If approved, the Region would then move to a three-stream wet/dry collection system. Approval of the expenditure for a three-stream wet/dry system ($38.5 million) is somewhat uncertain, given the climate of restraint in Ontario at this time. If not approved in the near future, Regional staff feel that construction of the compost facility would be delayed until 2000 to 2001.

Responsibility for waste management in Peel will be transferred from lower tier municipalities to the upper tier in January 1994.

In summary, the existing/committed residential waste diversion system will include all of the components of the existing system, and the addition of the following components:

- construction of new community recycling centres and satellite depots. The Region of Peel existing/committed scenario assumes that 1 urban community recycling centre, and 1 rural community recycling centre will be built within the five-year funding time frame. The Region has committed to 5 urban and 2 rural community recycling centres, but discussion with Regional staff indicated that it was reasonable to assume that 2 centres would go ahead. The urban community recycling centre will divert approximately 8,000 tonnes of recyclables, and 1,000 tonnes of household hazardous waste, and the rural community recycling centre will divert 20% of the urban centre tonnage (Williams, June 1993).
- construction of new MRF to process residential recyclable materials from Blue Box collection, community recycling centres and new mini-depots.
- additional materials will not be added to the residential Blue Box programs.
- distribution of 12,000 additional backyard composters. A sensitivity analysis with both the high and low backyard composter diversion rates was run.
- construction of a central composting facility.

Diversion Achieved

The existing/committed residential waste diversion system is estimated to divert 23 to 30% of the residential waste stream. The higher estimate assumes that all backyard composters would achieve a diversion rate of 240 kg/year, and that source reduction will increase to 5% (measured against a 1992 baseline) by the year 2000. The lower estimate assumes no source reduction of

residential waste, and that some backyard composters divert as little as 100 kg/year.

4.7.3 Region of Peel Direct Cost System

The assumptions listed in the Direct Cost methodology section (Section 4.3.5) apply to the diversion impact analysis conducted for the Region of Peel. The Direct Cost system builds on the existing/committed system. Diversion estimates for this system ranged from 40 - 47% in Region of Peel (excluding source reduction). Both estimates assume that 80% of leaf and yard waste would be diverted by curbside collection and backyard composting. The lower estimate assumes that 25% of households using backyard composters would divert 240 kg/composter/year, and the remainder (55% of single-family households, 15% of other households) would divert 100 kg/composter/year. In addition, the lower rate assumes that multi-family households would divert existing Blue Box materials (ONP, OCC, telephone directories, glass, metals, PET and HDPE) at 30% of the Quinte capture rates. Since the existing capture rate for telephone directories exceeds the Quinte capture rate, the existing Region of Peel capture rate (81.7%) was used.

The higher estimate (47%) assumes that all households using backyard composters would divert 240 kg/composter/year, and that multi-family households would divert existing Blue Box materials at the Quinte capture rates. Source reduction is not included in this estimate.

The 7% difference between the low and high rates of diversion was the second highest of all of the GTA Regions. This is due to the relatively high (27%) number of multi-family households in Peel. The low rate assumes that multi-family residents would divert Blue Box materials at 30% of the single-family rate, thus, the larger the number of multi-family residents, the greater the impact on the diversion sensitivity analysis.

4.7.4 Region of Peel Expanded Blue Box System

The assumptions listed in the Expanded Blue Box methodology section (Section 4.3.6) apply to the diversion impact analysis conducted for the Region of Peel. The Expanded Blue Box system builds on the existing/committed system. Diversion estimates for this system ranged from 38 - 48% in Region of Peel (excluding source reduction). The lower estimate assumes that 25% of households using backyard composters would divert 240 kg/composter/year, and the remainder (55% of single-family households, 15% of other households) would divert 100 kg/composter/year. In addition, the lower rate assumes that multi-family households would divert Expanded Blue Box materials at 30% of the Quinte capture rate. Since the existing capture rate for

telephone directories exceeds the Quinte capture rate, the existing Region of Peel capture rate (81.7%) was used.

The higher diversion rate (48%) assumes that all households using backyard composters would divert 240 kg/composter/year, and that multi-family households would divert Expanded Blue Box materials at the Quinte capture rates. Source reduction is not included in this estimate.

The 10% difference between the high and low rates of diversion was the second highest of all of the GTA Regions (after Metro). This is due to the relatively large number (27%) of multi-family households in Peel. The low diversion estimate assumes that multi-family residents would divert Expanded Blue Box materials at 30% of the single-family rate, thus, the larger the number of multi-family residents, the greater the impact on the diversion sensitivity analysis.

4.7.5 Region of Peel Wet/Dry System

The assumptions listed in the Wet/Dry methodology section (Section 4.3.7) apply to the diversion impact analysis conducted for the Region of Peel. The three-stream Wet/Dry system builds on the existing/committed system. Diversion estimates for this system ranged from 56 - 65% in Region of Peel (excluding source reduction). Both the high and low diversion estimates assume that 80% of leaf and yard waste would be diverted through curbside collection and backyard composting. The lower estimate assumes that multi-family households would divert 30% of their food waste through wet collection, and" single-family plus other" households would divert 80% of their wet waste through wet curbside collection plus backyard composting. In addition, the lower rate assumes that multi-family households would divert Expanded Blue Box materials at 30% of the Quinte capture rate.

The higher diversion rate (65%) assumes that all households would divert 80% of their food waste through a number of methods. "Single-family plus other" households would divert their food waste through wet curbside collection and backyard composting; multi-family households would divert their food waste through wet collection. In addition, multi-family households would divert Expanded Blue Box materials at the Quinte capture rates. Source reduction is not included in this estimate.

The 9% difference between the high and low rates of diversion was the second highest of all of the GTA Regions. This is due to the relatively large (27%) number of multi-family households in Region of Peel. The low diversion estimate assumes that multi-family residents would divert Expanded Blue Box materials at 30% of the single-family rate, thus, the larger

the number of multi-family residents, the greater the impact on the diversion sensitivity analysis.

4.7.6 Region of Peel Mixed Waste Processing System

The assumptions listed in the Mixed Waste Processing methodology section (Section 4.3.8) apply to the diversion impact analysis conducted for the Region of Peel. The Mixed Waste Processing system builds on the existing/committed system. Diversion estimates for this system ranged from 56-58% (for compost landfilled) and up to 77% (for compost marketed) in Region of Peel (excluding source reduction). The lower estimate assumes that 25% of households using backyard composters would divert 240 kg/composter/year, and the remainder (55% of single-family households, 15% of other households) would divert 100 kg/composter/year. The higher estimates assume that all households using backyard composters would divert 240 kg/composter/year.

4.7.7 Region of Peel Summary

The detailed waste composition calculations for Region of Peel for each of the six systems discussed above are shown in Schedule L. Included for each system are two sets of analyses: a base case or low diversion estimate, with low backyard composter and multi-family dry recyclables diversion (as discussed above), and a sensitivity analysis with higher backyard composter and multi-family dry recyclables diversion. Tables 4.12 and 4.13 summarize the detailed diversion estimates for each of the two sets of analyses.

4.8 Residential System Diversion Estimates for Region of Halton

Diversion estimates were not developed for all six residential systems for Region of Halton. Only the existing and existing/committed systems were considered in the analysis. Diversion estimates for the two residential systems considered for Region of Halton are presented in Schedule M. Any unique Region-specific features of the estimates are discussed in this section.

4.8.1 Region of Halton Existing System

Existing System Description

In 1992, an estimated 137,018 tonnes of residential waste were generated in Halton. Of this, 42,218 tonnes were diverted and 88,800 tonnes disposed for an estimated residential waste diversion rate of 35%.

Residential System Diversion Estimates (Base Case)
Region of Peel

Component	Existing System Diversion (tonnes)	Existing/ Committed Diversion (tonnes)	Direct Cost System Diversion (tonnes)	Expanded Blue Box Diversion (tonnes)	Wet/Dry System Diversion (tonnes)	MSW (compost landfilled) (tonnes)	MSW (compost marketed) (tonnes)
Total Residential Waste (tonnes)	62,198	74,398	125,998	122,142	176,459	176,805	244,009
Paper							
Newspaper	21,534	22,034	36,510	36,510	36,510	41,463	51,137
Corrugated cardboard (OCC)	1,234	1,734	4,333	4,333	4,333	6,494	7,914
Telephone Directories	712	712	712	712	712	826	860
Mixed paper	469	1,969	1,969	15,266	15,266	25,239	43,686
Subtotal (Paper)	23,949	26,449	43,524	56,821	56,821	74,023	103,598
Glass	6,674	7,174	9,833	9,833	9,833	8,989	8,989
Tinplate Steel (ferrous)						0	0
Aluminum (non-ferrous)						0	0
Subtotal Metal (Commingled)	6,137	6,637	9,756	9,756	9,756	12,380	12,380
Plastic							
PET			197	197	197	290	290
HDPE			6,764	6,764	6,764	4,150	4,150
Other Plastic			0	674	674	0	0
Subtotal (Plastic)	694	944	6,961	7,635	7,635	4,440	4,440
Organics							
Food wastes	8,049	8,865	12,200	12,200	48,691	38,092	63,984
Yard waste	11,449	12,333	31,729	13,902	31,729	25,494	37,085
Subtotal (Organics)	19,498	21,198	43,929	26,102	80,419	63,586	101,069
Wood Waste	2,490	2,490	2,490	2,490	2,490	2,496	2,502
Construction/Demolition Waste	142	2,142	2,142	2,142	2,142	2,282	2,421
Disposable Diapers			0			0	0
Textiles/Leather/Rubber	390	890	890	890	890	2,136	2,136
Other	2,224	6,474	6,474	6,474	6,474	6,474	6,474
Subtotal (Wood - Other)	5,246	11,996	11,996	11,996	11,996	13,387	13,533
TOTAL	62,198	74,398	125,998	122,142	176,459	176,805	244,009
Low Diversion Estimate =	20%	23%	40%	38%	56%	56%	77%

Table 4.13

Residential System Diversion Estimates (Sensitivity Analysis)
Region of Peel

Component	Existing System Diversion (tonnes)	Existing/ Committed Diversion (tonnes)	Direct Cost System Diversion (tonnes)	Expanded Blue Box Diversion (tonnes)	Wet/Dry System Diversion (tonnes)	MSW (compost landfilled) (tonnes)	MSW (compost marketed) (tonnes)
Total Residential Waste (tonnes)	64,002	77,882	148,616	151,767	205,540	182,674	245,396
Paper							
Newspaper	21,534	22,034	44,950	44,950	44,950	41,463	51,137
Corrugated cardboard (OCC)	1,234	1,734	5,335	5,335	5,335	6,494	7,914
Telephone Directories	712	712	712	712	712	826	860
Mixed paper	469	1,969	1,969	18,804	18,804	25,239	43,686
Subtotal (Paper)	23,949	26,449	52,966	69,801	69,801	74,023	103,598
Glass	6,674	7,174	12,106	12,106	12,106	8,989	8,989
Tinplate Steel (ferrous)						0	0
Aluminum (non-ferrous)						0	0
Subtotal Metal (Commingled)	6,137	6,637	12,011	12,011	12,011	12,380	12,380
Plastic							
PET			242	242	242	290	290
HDPE			8,328	8,328	8,328	4,150	4,150
Other Plastic			0	830	830	0	0
Subtotal (Plastic)	694	944	8,570	9,400	9,400	4,440	4,440
Organics							
Food wastes	9,276	11,235	19,239	19,239	58,498	42,139	65,040
Yard waste	12,026	13,448	31,729	17,215	31,729	27,316	37,416
Subtotal (Organics)	21,302	24,682	50,968	36,454	90,226	69,455	102,456
Wood Waste	2,490	2,490	2,490	2,490	2,490	2,496	2,502
Construction/Demolition Waste	142	2,142	2,142	2,142	2,142	2,282	2,421
Disposable Diapers			0			0	0
Textiles/Leather/Rubber	390	890	890	890	890	2,136	2,136
Other	2,224	6,474	6,474	6,474	6,474	6,474	6,474
Subtotal (Wood - Other)	5,246	11,996	11,996	11,996	11,996	13,387	13,533
TOTAL	**64,002**	**77,882**	**148,616**	**151,767**	**205,540**	**182,674**	**245,396**
Higher Diversion Estimate =	**20%**	**25%**	**47%**	**48%**	**65%**	**58%**	**77%**

Residential recycling services in Halton consisted of the following components:

- residential curbside recycling services to 116,320 households
- four drop-off depots throughout Region
- Regional MRF to process recyclables
- 25,700 backyard composters
- leaf and yard waste composting at several different privately owned facilities throughout the Region and municipal site in Oakville
- WASTEWISE goods exchange and recycling depot
- two permanent HHW depots operated by Region
- curbside and drop-off services for white goods
- extensive promotion and education program

Estimated residential waste diversion was made up of the following activities:

Blue Box curbside	23,450 tonnes
Dry Recyclables from depots	3,600 tonnes
Leaf and yard waste	15,000 tonnes
Household wet waste through backyard composters	6,168 tonnes
Total diverted 1992	42,218 tonnes

This information is summarized in Table 4.14.

The following text describes residential waste diversion activities under a number of headings. Information was obtained from the following sources:

- survey of regional and municipal staff, February-March, 1993.

- on-going telephone contacts with regional and municipal staff, February-October 1993

For ease of presentation, each value will not be referenced in the text.

Residential Recycling and Collection

In 1992, the Region of Halton contained an estimated 109,680 households. Of these, 72,008 were single-family households, 16,080 were multi family households and 21,592 other households. There were 318,893 residents in the Region in 1992 (Hardy Stevenson Associates, 1993).

In 1992 all households received curbside collection. Curbside recycling is organized on a regional level and is contracted out to a private hauler. In 1992, approximately 23,450 tonnes of recyclables were collected through

Table 4.14

Summary of Existing Residential Waste Diversion System Performance
Region of Halton
1992

Regional Characteristics	
Regional Population	318,893
Total Number of Households	109,680
— single-family	72,008
— multi-family	16,080
— other	21,592
Households served by curbside	109,680
Number of backyard composters distributed	25,700
Residential Material Diverted in 1992	
Blue Box	23,450 tonnes
Depots (Blue Box materials)	3,600 tonnes
Leaf and yard waste collection and composting	15,000 tonnes
Diversion through backyard composters	6,168 tonnes
Total residential waste diverted	48,218 tonnes
Residential waste diversion summary	
Residential waste generated	137,018 tonnes
Residential waste diverted	48,218 tonnes
Residential waste disposed	88,800 tonnes
Residential waste diversion rate	35%

Sources: Hardy Stevenson Associates, 1993.
Regional and Municipal Staff, 1993.

residential curbside programs. The participation rate for the Blue Box program has been reported at 100%, due to the mandatory recycling requirement in the Region.

There are four drop-off container stations in the Region which accept ONP, OCC, glass, scrap metal, drywall and green wastes. In 1992, the four drop-off container stations diverted 3,600 tonnes of material.

The following tonnages of materials were collected from residential Blue Box programs and drop-off depots in the Region in 1992:

- 15,923 tonnes of ONP and OMG (commingled);
- 2,177 tonnes of OCC;
- 3,650 tonnes of Aluminum, Steel and Plastic (commingled);
- 4,944 tonnes of Glass;
- 2,268 tonnes of Green Waste.

Residential Household Composting

At the end of 1992, 25,700 backyard composting units had been distributed in the Region of Halton. Composters were distributed to residents by each of the individual municipalities. It is estimated that 6,168 tonnes of organic material were diverted through this program in 1992, assuming a diversion rate of 240 kg/composter/year.

Residential Leaf and Yard Waste Collection/Composting Facilities

In 1992, collection of leaf and yard waste in Halton totaled 15,000 tonnes. Leaf and yard waste collected at the Region's transfer stations were delivered to Scott's Farms in Milton as were leaf and yard wastes collected in Halton Hills. Oakville operates its own composting site for leaf and yard waste, and Burlington and Milton send their collected leaf and yard wastes to local farmers and landscape companies. Burlington provides a seasonal drop-off service for brush and Christmas trees which the City chips and offers back to the public or uses in parks. Milton also collected pumpkins following Halloween and delivered them to a hog farmer for animal feed

Other Residential Waste Diversion

Reuse Activities

The Region operates a community-based resource centre and diversion facility called WASTEWISE. It is staffed by a combination of paid employees and volunteers. It serves as:

1. an education centre and information service,
2. a reuse centre accepting and selling office furniture, household goods etc.,
3. a repair area for broken household appliances, power tools and equipment and
4. a recycling depot for materials not accepted by the Blue Box program, including six grades of plastics, eight grades of paper, scrap metal, textiles, aggregate, egg cartons, rubber, film canisters, coat hangers etc.

Household Hazardous Waste (HHW) Program

The Region operates two permanent HHW depots: one in Milton open three days/week and staffed by the Region, the other in Burlington, open one day a week and operated mainly by Laidlaw Environmental Services. In 1992 it is estimated that the two HHW facilities diverted the following quantities of waste:

192,200 litres of HHW;
2,977 vehicle batteries;
1,285 propane tanks;
45 fire extinguishers.

White Goods

Halton has both curbside and drop-off services for white goods. In 1992, white goods collection was estimated by the Region to total 370 tonnes. This material was delivered to scrap dealers for shredding and recycling.

Residential Promotion and Education

The Region and the area municipalities are jointly responsible for 3Rs education and promotion, except for the HHW program which is promoted by the Region. Municipalities conducted advertising, seminars and open houses to promote backyard composting. Halton is conducting a survey in 1993 to determine the community's interest in backyard composting. WASTEWISE also provided education and information and is producing a guide on starting a community resource centre.

Public Sector Material Recovery Facilities (MRFs)

In 1992, all of Halton's collected recyclable materials were processed at the Regional MRF in Oakville. This facility was owned by the Region and operated under contract by Halton Recycled Resources Inc. The facility was designed to process 30,000 tonnes/year of materials and in 1992, received

25,000 tonnes of recyclables for processing. The facility operated 24 hours per day, 5 days per week with a daily staff of 36.

Generally, 3% - 5% of the material delivered for processing is left as non-recyclable residue for disposal.

Diversion Achieved

In 1992, approximately 48,218 tonnes of residential waste were diverted from landfill. The residential diversion rate was therefore approximately 35%. This rate is the highest of any of the five GTA Regions, due in part to the large amount of leaf and yard waste diverted in the Region, both through curbside collection and backyard composting. Over the longer term (to the year 2000), the existing system could be expected to achieve 40% diversion of residential waste. This estimate assumes that source reduction will increase to 5% (measured against a 1992 baseline) by the year 2000.

4.8.2 Region of Halton Existing/Committed System

Existing/Committed System Description

The existing/committed system for Halton is considered to encompass all facilities committed in the Region's capital funding budgets for the years 1993 to 1997, and any policy commitments at the local, regional, provincial or federal level, which had been announced by the end of 1992.

A review of Region of Halton's 1992 Development Charges Study and the 1993 Capital and Operating Budgets and five year forecast for Waste Diversion indicated the following (Future Urban Research, 1993):

- $500,000 has been allocated in the 1993 capital budget for the design and construction of a new Household Hazardous Waste Depot on location at the new Regional landfill site.

- $25,000,000 has been allocated for the design and construction of a Regional Composting facility. However, it is important to note that no provision has been made for the facility in the 1993 Capital Budget and five year forecast.

- $255,000 has been allocated in the Development Charges Study for the purchase of recycling vehicles over the period 1993 to 1997. However, the Operating Budget indicated that the vehicles would be sold (for approximately $255,000), in conjunction with the new tender contract for the collection of recyclables.

- $207,000 has been allocated in the operating budget as a result of a change in the service level of the Household Hazardous Waste Depot in Burlington. The facility will operate each Saturday of the month as opposed to once per month as in prior years.

- $87,000 has been allocated in the operating budget as a result of the "Shared Responsibility Demonstration Project", whereby the Region is responsible for the collection of recyclables while the Province in conjunction with the Commercial/Industrial sector (Halton Recycled Resources) is responsible for provision of the materials recycling facility. The province has provided a grant for the costs associated with the processing of the materials. The grant is for a one year term with an option to renew in 1994. The new facilities at Halton Recycled Resource's MRF have essentially allowed operations at the Region owned MRF in Oakville to be terminated. A reduction of $145,000 in the 1993 operating budget has been estimated as a result of the closure of the Regional MRF.

- $34,300 has been allocated in the 1993 operating budget as the result of expansion to the Igloo Program. Seventeen new igloos will be purchased, twelve to replace existing units and five for new locations.

- $107,400 has been estimated in the 1993 operating budget as the result of additional Waste Reduction Education Programs and Display Materials design to increase participation rates.

The Region expanded the range of materials collected in its Blue Box program in 1993 to include five new materials: polystyrene, aluminum foil, HDPE, boxboard and fine paper. It will also replace 12 existing igloos and install 5 new ones: 4 in Acton and 1 at the new GO station. The municipalities will distribute additional backyard composters to residents (for study purposes, 5,000 new composters were assumed for the study. This is to be confirmed with the municipalities). Consideration is being given to constructing a central composting facility (possibly shared with Peel). The Town of Oakville has implemented a ban on collection of grass clippings.

Implementation of the 3Rs Regulations under the Environmental Protection Act (EPA) will not impact residential waste diversion practices by municipalities within the region, as all municipalities meets the requirements of the proposed regulations for residential waste management. Regulations requiring owners of buildings containing 6 or more units to provide recycling to residents will not have an impact in Halton, because all multi-family residents already participate in Blue Box programs.

In summary, the existing/committed residential waste diversion system will include all of the components of the existing system, and the addition of the following components:

- new MRF to begin operating in 1993, owned by Halton Recycled Resources and operated under contract to the Region. This is replacing the existing Regional MRF.
- 5 additional igloo sites: 1 in new GO station and 4 in Acton. Based on discussions with the Region, it was assumed that these would divert an additional 50 tonnes/year of Blue Box materials in total.
- reduction in curbside collection frequency to bi-weekly.
- reduction in container drop-off sites from 4 to one.
- 5 additional materials added to the residential Blue Box programs (polystyrene, aluminum foil, HDPE, boxboard and fine paper). Based on discussions with the Region, it was assumed that these new materials would divert an additional 5,000 tonnes/year of Blue Box materials.
- distribution of additional backyard composters (5,000 new composters were assumed)
- construction of a central composting facility (possibly in conjunction with Peel)
- ban on collection of grass clippings in Town of Oakville

Diversion Achieved

The existing/committed residential waste diversion system is estimated to divert 40% to 45% of the residential waste stream. Both estimates assume that 5,000 additional tonnes of recyclables would be diverted through the expansion of the Blue Box program. The 5,000 new backyard composters were assumed to divert 240 kg/composter/year, which would amount to additional diversion of 1,200 tonnes/year. The 5 new Igloos were assumed to divert 10 tonnes/year each of dry recyclables. The total additional diversion for the existing/committed system would amount to 6,250 tonnes, or a total diversion rate of 40%. The higher estimate of 45% assumes that source reduction will increase by 5% (measured against a 1992 baseline) by the year 2000.

4.8.3 Other Residential Diversion Systems for Region of Halton

No other diversion systems were investigated for Region of Halton, since Halton has its own landfill which was recently opened. Halton is therefore not part of the IWA landfill site selection process.

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5.0 IC&I WASTE PROJECTIONS AND COMPOSITION

5.1 Introduction

Residential and IC&I waste generation and composition estimates and future waste projections were estimated separately for each GTA region for this study. Residential waste estimates were addressed in Chapter 3.

This chapter presents the basis for estimates of historical and future IC&I waste generation in the GTA regions. Estimated IC&I waste composition is also presented, and the method by which the IC&I waste composition estimates were developed is described.

5.2 IC&I Waste Generation Estimates

5.2.1 Data and Methodology Used

IC&I waste generation estimates for the GTA were developed by examining IC&I waste generation and disposal patterns in each GTA region for the period 1986 to 1992. Historical waste generation rates (expressed as tonnes/employee/year) were applied to future employment projections for each GTA region to estimate future IC&I waste generation by region. These estimates were added together to estimate IC&I waste generation projections for the GTA for the period 1993 to 2015. Where possible, IC&I waste projections were based on IC&I waste generation rates recorded for 1987, as this is the year from which provincial waste diversion objectives will be measured in the future. Where 1987 data were unusually high, an appropriate or typical generation rate was chosen, based on the available data.

Historical IC&I waste disposal data for each region for the years 1986 to 1992 are presented in Table 5.1. Table 5.2 presents estimated employment data (where available) and estimated per-employee generation rates for those years. Employment data for the years 1986 to 1992, and employment projections for 1993 to 2015 are presented in Table 5.3 (Hemson Consultants Ltd., 1989, and Clayton Research Associates, 1991). Employment data for the years 1987 through 1990 were interpolated (Hardy Stevenson and Associates, 1993).

The methods by which the historical waste disposal data and the future employment projections were used to estimate future IC&I waste generation are discussed by GTA region in the following text.

Table 5.1
Summary of Available Data on IC&I Waste Disposal in GTA Regions 1986-1992

Year	Durham IC&I Disposal (tonnes)	Halton IC&I Disposal (tonnes)	Peel IC&I Disposal (tonnes)	Metro IC&I Disposal (tonnes)	York IC&I Disposal (tonnes)	Total GTA IC&I Disposal (tonnes)
1986	*152,125*			1,445,857	221,650	1,819,632
1987	161,826	*	449,360	1,490,098	339,487	2,440,772
1988	190,509	*	478,926	1,405,066	336,712	2,411,213
1989	189,353	*	470,449	1,241,573	377,296	2,278,671
1990	190,264	101,000	361,513	1,169,697	303,689	2,126,163
1991	118,694	70,000	224,086	704,492	161,643	1,278,915
1992	62,615	13,800	44,203	200,015	26,434	347,066

Notes:

1) For all Regions, IC&I waste quantities to landfill were calculated by difference between total waste to landfill and residential waste to landfill

2) 1986 Durham value equals total waste landfilled (from SWEAP 4.1 report,1988) less residential waste to landfill(estimated from 1987 generation rate)

3) 1987 Durham value equals total waste landfilled (from MacLaren Waste Study,1988) less residential waste to landfill

4) Total waste to landfill for Durham taken from Metro landfill records for 1988-1992; tonnages for Brock & Scott landfills added to total waste landfilled.

5) Residential waste to landfill taken from Region of Durham landfill records.

6) Metro landfill data taken from Metro Toronto landfill records

7) 1991 Metro IC&I quantity excludes waste export. Metro assumes that 400,000 tonnes were exported, which is assumed to be primarily IC&I

8) 1992 Metro IC&I quantity excludes waste export. Metro assumes that 1,000,000 tonnes were exported, which is assumed to be primarily IC&I

9) 1991 Peel IC&I quantity excludes waste export. Peel assumes that 53,125 tonnes were exported, which is assumed to be primarily IC&I

10) 1992 Peel IC&I quantity excludes waste export. Peel assumes that 253,183 tonnes were exported, which is assumed to be primarily IC&I

11) 1988 residential landfill quantity for Region of York from Table 2-1, Waste Management Study, 1989, MacLaren

12) 1988 residential landfill percentage for Region of York applied to 1986 and 1987 to calculate quantity going to landfill (31.8%)

13) 25000 tonnes added to total waste landfilled for the Township of King and Georgina Landfills for 1986-1991; 15000 tonnes added for 1992. (personal communication with Mr. J. Flewelling - Region of York)

* Halton landfill data supplied by Region of Halton; there were no landfill data available from the Region prior to 1990. Date provided by MOEE in July 1993 were not included in the analysis. These indicate that IC&I waste landfilled in 1987, 1988 and 1989 totalled 109,100, 111,100 and 93,300 tonnes respectively.

Table 5.2

Estimated Number of Employees
and Estimated IC&I Generation Rates
in GTA Regions
1986-1992

Year	Estimated Number of Employees					Estimated IC&I Disposal Rate (tonnes/employee/year)				
	Durham	Halton	Peel	Metro	York	Durham	Halton(1)	Peel	Metro	York
1986	137,264	119,000	304,000	1,349,000	170,000	1.11			1.07	1.30
1987	143,507	124,639	320,182	1,368,998	183,778	1.13		1.40	1.09	1.85
1988	150,035	130,546	337,227	1,389,293	198,673	1.27		1.42	1.01	1.69
1989	156,860	136,733	355,178	1,409,888	241,775	1.21		1.32	0.88	1.56
1990	163,995	143,213	374,086	1,430,789	232,182	1.16	0.71	0.97	0.82	1.31
1991	171,455	150,000	394,000	1,452,000	252,000	0.69	0.47	0.70	0.76	0.64
1992	176,609	154,223	404,695	1,464,504	261,654	0.35	0.09	0.73	0.82	0.10

Notes:
1) Halton data are incomplete
2) Employment data from Hardy Stevenson & Associates, 1993.
3) Estimated IC&I disposal rate for years after 1989 are presented to show dramatic decrease in disposed IC&I waste in each GTA Region from 1990 on, as a result of increased waste export and other factors.

Table 5.3

**Employment Estimates by GTA Region 1986 to 1992,
and
Employment Projections by GTA Region, 1993 to 2015**

Year	Metro Toronto	Durham	Halton	Peel	York
1986	1,349,000	137,264	119,000	304,000	170,000
1987	1,368,998	143,507	124,639	320,182	183,778
1988	1,389,293	150,035	130,546	337,227	198,673
1989	1,409,888	156,860	136,733	355,178	241,775
1990	1,430,789	163,995	143,213	374,086	232,182
1991	1,452,000	171,455	150,000	394,000	252,000
1992	1,464,504	176,609	154,223	404,695	261,654
1993	1,477,116	181,919	158,565	415,679	271,678
1994	1,489,836	187,388	163,029	426,962	282,085
1995	1,502,666	193,021	167,618	438,552	292,892
1996	1,515,607	198,824	172,337	450,455	304,112
1997	1,528,659	204,802	177,189	462,682	315,762
1998	1,541,823	210,959	182,177	475,241	327,859
1999	1,555,101	217,301	187,306	488,141	340,419
2000	1,568,493	223,834	192,579	510,391	353,460
2001	1,582,000	230,564	198,000	515,000	367,000
2002	1,592,104	235,117	202,180	522,314	375,906
2003	1,602,273	239,761	206,448	529,733	385,027
2004	1,612,507	244,496	210,806	537,256	394,370
2005	1,622,807	249,325	215,256	544,887	403,940
2006	1,633,172	254,249	219,800	552,626	413,742
2007	1,643,603	259,270	224,440	560,474	421,560
2008	1,654,102	264,391	229,178	568,435	429,525
2009	1,664,667	269,613	234,016	576,508	437,641
2010	1,675,299	274,938	238,956	584,696	445,910
2011	1,686,000	280,368	244,000	593,000	454,335
2012	1,696,769	283,142	249,151	601,422	459,360
2013	1,707,606	285,944	254,411	609,964	464,440
2014	1,718,513	288,773	259,781	618,627	469,576
2015	1,729,490	291,631	265,265	627,414	474,769

Sources: Hemson Consultants Ltd, 'Employment Forecasts for the Greater Toronto Area to 2031', prepared for the Office of the Greater Toronto Area, October 1989, and Clayton Research Associates, 'Migration Trends in the Greater Toronto Area,' prepared for the Office of the Greater Toronto Area, Dec., 1991.

Employment data for the years 1987 through 1990 were interpolated (Hardy Stevenson and Associates, 1993.)

5.2.2 IC&I Waste Generation Estimates for Region of Durham

It was assumed for analysis that most IC&I waste from Region of Durham was disposed in the Brock West landfill. Data were obtained from Metro Toronto staff (Scanga P. Metro Works Department, 1993) on the quantities of total waste disposed by Durham sources (residential and IC&I) in Metro landfills for the years 1986 to 1992. There was some discrepancy between the residential quantities reported by Metro and Durham (Collis, Region of Durham, 1993). For this analysis, the Study Team assumed that the residential quantities reported by Durham (which were lower than those reported by Metro) were correct. These were subtracted from the total waste quantities reported by Metro to estimate the IC&I quantities generated in Durham and disposed at Metro landfills. This method may slightly underestimate residential waste generation in Region of Durham, and overestimate IC&I waste generation. However, the differences are not expected to be significant.

It was assumed that there was minimal waste diversion occurring in the IC&I sector in 1986 and 1987, hence the quantity of IC&I waste landfilled was close to the quantity generated.

For each year, 1986 to 1992, the IC&I disposed waste quantity (which as discussed, is assumed to be close to the generated waste quantity) was divided by the number of employees in Region of Durham for that year to yield an estimated IC&I waste generation rate. The 1987 rate was estimated at 1.13 tonnes/employee/year (calculated by dividing the estimated 161,826 tonnes disposed by the estimated 143,507 employees in the Region for that year). The 1986 IC&I generation rate was estimated at 1.11 tonnes/employee/year, and the 1988 IC&I waste generation rate was estimated at 1.27 tonnes/employee/year.

Future IC&I waste projections for the Region of Durham were estimated using the 1987 IC&I waste generation rate, which was a typical value for those years, and is the value experienced in the year which will form the benchmark for measuring diversion towards the Province's 50% diversion goal. Employment projections presented in Table 5.3 were multiplied by the rate of 1.13 tonnes/employee/year to estimate IC&I waste generation in the Region of Durham to the year 2015. The future IC&I waste projections are shown in Table 5.4, and indicate that IC&I waste generation in the Region is estimated to range from approximately 205,000 tonnes in 1993 to approximately 330,000 tonnes in the year 2015. These estimates represent approximately 7% of the GTA IC&I waste stream in 1993, and approximately 8% of GTA IC&I waste by the year 2015.

Table 5.4

IC&I Waste Generation Projections for GTA Regions, 1993 to 2015

Year	Durham Region IC&I Waste Generation (tonnes)	Halton Region IC&I Waste Generation (tonnes)	Metro Toronto IC&I Waste Generation (tonnes)	Peel Region IC&I Waste Generation (tonnes)	York Region IC&I Waste Generation (tonnes)	Total GTA IC&I Waste Generation (tonnes)
1993	205,568	112,581	1,610,056	581,951	429,251	2,939,408
1994	211,748	115,751	1,623,921	597,747	445,694	2,994,861
1995	218,114	119,009	1,637,906	613,973	462,769	3,051,771
1996	224,671	122,359	1,652,012	630,637	480,497	3,110,176
1997	231,426	125,804	1,666,238	647,755	498,904	3,170,128
1998	238,384	129,346	1,680,587	665,337	518,017	3,231,671
1999	245,550	132,987	1,695,060	683,397	537,862	3,294,857
2000	252,932	136,731	1,709,657	714,547	558,467	3,372,335
2001	260,537	140,580	1,724,380	721,000	579,860	3,426,357
2002	265,682	143,548	1,735,393	731,240	593,931	3,469,794
2003	270,930	146,578	1,746,478	741,626	608,343	3,513,954
2004	276,280	149,672	1,757,633	752,158	623,105	3,558,848
2005	281,737	152,832	1,768,860	762,842	638,225	3,604,496
2006	287,301	156,058	1,780,157	773,676	653,712	3,650,906
2007	292,975	159,352	1,791,527	784,664	666,065	3,694,583
2008	298,762	162,716	1,802,971	795,809	678,650	3,738,908
2009	304,663	166,151	1,814,487	807,111	691,473	3,783,885
2010	310,680	169,659	1,826,076	818,574	704,538	3,829,527
2011	316,816	173,240	1,837,740	830,200	717,849	3,875,845
2012	319,950	176,897	1,849,478	841,991	725,789	3,914,105
2013	323,117	180,632	1,861,291	853,950	733,815	3,952,804
2014	326,313	184,445	1,873,179	866,078	741,930	3,991,945
2015	329,543	188,338	1,885,144	878,380	750,135	4,031,540

5.2.3 IC&I Waste Generation Estimates for Metro Toronto

Data on IC&I waste disposed at Metro Toronto landfills for the period 1986 to 1992 were supplied to the Study Team by Metro Toronto staff (Scanga, P. Metro Works Department, 1993). It was assumed for this analysis that there was minimal waste diversion occurring in the IC&I sector in 1986 and 1987, hence the quantity of IC&I waste landfilled at Metro Toronto landfills was close to the quantity generated.

The 1987 IC&I waste quantity disposed (1,490,098 tonnes) was divided by the estimated number of employees in Metro Toronto in 1987 (1,368,998) to yield an estimated IC&I waste generation rate of 1.09 tonnes/employee/year. This was very close to the IC&I waste generation rate of 1.07 tonnes/employee/year calculated using 1986 data, and the estimated 1988 rate of 1.04 tonnes/employee/year.

Future IC&I waste projections for Metro Toronto were based on the 1987 value of 1.09 tonnes/employee/year. Employment projections presented in Table 5.3 were multiplied by the waste generation rate to estimate future IC&I waste generation. The estimates indicated that approximately 1,610,000 tonnes of waste would be generated by Metro Toronto IC&I sources in 1993, and an estimated 1,885,000 tonnes would be generated in the year 2015. On this basis, Metro Toronto sources would be responsible for generation of 55% of the GTA IC&I waste stream in 1993, and for approximately 47% of the GTA IC&I waste stream in the year 2015.

5.2.4 IC&I Waste Generation Estimates for Region of York

Data on IC&I waste disposed by Region of York sources were obtained from Metro Toronto for the Keele Valley landfill (Scanga, Metro Works Department, 1993), and from Region of York staff for the two small landfills in the Region (Flewelling, Region of York, 1993).

It was assumed for analysis that there was minimal waste diversion occurring in the IC&I sector in 1986 and 1987, hence the quantity of IC&I waste landfilled was close to the quantity generated.

The IC&I generation rate was calculated by dividing the tonnes of IC&I waste disposed at landfill by the estimated number of employees in the Region of York in the same year, yielding an estimated value of 1.30 tonnes/employee/year for 1986. The 1987 IC&I waste generation rate was estimated to be 1.85 tonnes/employee/year, the 1988 rate was estimated to be 1.71 tonnes/employee/year, and the 1989 rate was estimated to be 1.56 tonnes/employee/year. The 1986 value appeared to be low when compared to the four year average (1986 - 1989) value of 1.61 tonnes/employee/year. The 1987 rate was high (1.85 tonnes/employee/year), perhaps due to increased

construction activity in the Region. There is no construction waste information available for 1987, however, data for 1988 indicate that construction waste made up 21% (MacLaren, 1989) of the total waste landfilled. The average of the 1986 and 1987 IC&I generation rates was 1.58 tonnes/employee/year. This rate agrees very closely with the four year average, therefore projections of future IC&I waste generation in the Region were based on this value.

The estimates indicate that approximately 429,000 tonnes of IC&I waste will be generated by Region of York sources in 1993, and approximately 750,000 tonnes will be generated in the year 2015. This contributes approximately 15% and 19% to the GTA IC&I stream in these years respectively.

5.2.5 IC&I Waste Generation Estimates for Region of Peel

Table 5.1 summarizes data obtained from Region of Peel staff (Morgan-Fraser, L. Region of Peel, 1993) on the quantities of IC&I waste disposed at Region of Peel landfills from 1987 to 1992. It was assumed for this analysis that there was minimal waste diversion and waste export occurring in the IC&I sector in 1987, hence the quantity of IC&I waste disposed was close to the quantity generated.

The quantity of IC&I waste disposed in 1987 (449,360 tonnes) was divided by the number of employees for 1987 (320,182) to estimate an IC&I generation rate of 1.40 tonnes/employee/year. Projections of future IC&I waste generation in the Region were based on this value. Employment projections presented in Table 5.3, were multiplied by the calculated IC&I waste generation rate to estimate future IC&I waste generation for the Region. The results are presented in Table 5.4. The table shows that IC&I waste generation by Region of Peel sources is estimated at 582,000 tonnes in 1993, and 878,000 tonnes in the year 2015. This equates to 20% to 22% of the estimated IC&I waste to be generated in GTA in these years respectively.

5.2.6 IC&I Waste Generation Estimates for Region of Halton

It was difficult to accurately estimate IC&I waste generation for the Region of Halton, as data on IC&I waste disposed were not available for any year prior to 1990 at the time this analysis was carried out. By 1990, high tipping fees had resulted in many IC&I generators disposing of waste south of the border in the United States. In addition, waste diversion by the IC&I sector was likely affecting the quantities of waste being disposed. Therefore, reported IC&I waste disposed was likely less than the quantity of IC&I waste generated.

In spite of these limitations, preliminary estimates of IC&I waste generation for Region of Halton were carried out using available 1990 data. Subsequent to these estimates being carried out, additional Halton data were supplied to

the Study Team by MOEE staff (MOEE, 1993). Future drafts of this report will take these additional data into account.

The recorded quantity of IC&I waste disposed from Region on Halton IC&I sources in 1990 (101,000 tonnes) was divided by the number of employees for 1990 (143,213) to yield an estimated IC&I waste generation rate of 0.71 tonnes/employee/year. Future IC&I waste generation projections were based on this value, even though it is significantly lower than the generation rates estimated for other GTA Regions. Employment data presented in Table 5.3 formed the basis of the IC&I waste projections for the Region of Halton (which are considered underestimates) presented in Table 5.4. These show that the Region of Halton is estimated to generate approximately 113,000 tonnes of IC&I waste in 1993, and approximately 189,000 tonnes of IC&I waste in the year 2015. These estimates represent 3.8% and 4.7% of the estimated GTA IC&I waste stream in the years 1993 and 2015 respectively. However, these are considered underestimates, and will be updated as discussed to incorporate additional available data at a future date.

5.2.7 IC&I Waste Generation Estimates for the GTA

The above estimates for each GTA region were combined to estimate the quantities of IC&I waste which would be generated in the GTA for the years 1993 to 2015. These estimates are presented in Table 5.4, and show that an estimated 2.94 million tonnes of IC&I waste will be generated in the GTA in 1993, and increasing to an estimated 4 million tonnes in the year 2015. Because the estimates for IC&I waste generation in the Region of Halton may be low, this may be a slight underestimate, and may be increased slightly in later drafts of this report, to incorporate additional Region of Halton data.

5.3 IC&I Waste Allocation To IC&I Generators

5.3.1. General

An estimate of the quantity and composition of the IC&I waste generated in the GTA was required in order to estimate the impacts of various waste diversion measures on the quantity and composition of waste diverted and disposed over time. Because of the way in which the proposed 3Rs regulations (MOEE, 1993) are written, it was also necessary to estimate the quantity and composition of waste generated by various IC&I groups.

A method was developed to allocate the estimated IC&I waste generated in GTA to different IC&I sources, and to estimate the IC&I waste quantities and composition generated by these sources, in order that the impacts of various IC&I waste diversion strategies could be estimated.

5.3.2. Method Used

A number of studies have been carried out to characterize the composition of IC&I waste generated by different areas (Gore & Storrie Ltd., 1991, Proctor & Redfern, SENES Consultants Ltd., 1991, RIS, CH2M Hill, KPMG, 1993, R.W. Beck & Associates, 1992, CH2M Hill, 1991, Matrix Management Group, 1988). The results depend on the employment and industrial mix of the jurisdiction being studied. The results of a number of waste composition studies (Gore & Storrie Ltd., 1991, Proctor & Redfern, SENES Consultants Ltd., 1991, RIS, CH2M Hill, KPMG, 1993, R.W. Beck & Associates, 1992, CH2M Hill, 1991, Matrix Management Group, 1988) were combined with employment data for the GTA to estimate the quantities and composition of waste generated by different IC&I sectors in each GTA region. These estimates were combined to estimate the composition of GTA IC&I waste

The calculations were carried out in two steps:

- waste allocation to different IC&I sectors, and
- IC&I waste composition estimates for different sectors and GTA regions.

Each calculation will be described separately in the following text.

5.3.3. Waste Allocation Estimates.

IC&I waste allocation estimates were developed for the GTA regions, and aggregated to estimate GTA totals. IC&I waste was allocated to the GTA regions by multiplying an indicator of IC&I waste generation activity (number of employees in the different IC&I sectors in the GTA) by a unit waste generation rate (tonnes/employee/year), to estimate the proportion of waste generation contributed by different IC&I sectors. Sectors were defined according to the Standard Industrial Classification (SIC) used by Statistics Canada.

Employment is a commonly-used indicator in IC&I waste generation estimates for a number of reasons including:

- employment data are readily available in most jurisdictions across North America and are updated on a regular basis
- using employment allows meaningful comparison of generation rates across different IC&I sectors.

Employment data were selected as the indicator of IC&I waste generation activity for all GTA sectors except the construction and demolition sector. Construction industries (SIC 40 to 44) were not included in the waste allocation estimates, since a construction company registered within a

particular region often carries out their services, and hence leaves their waste, outside of the region. An estimate of construction and demolition (C&D) waste was obtained from historical data for each region (MacLaren Engineers, 1988 and Metro Works Department, 1990).

Detailed employment data for each GTA Region were purchased from Dun and Bradstreet (D&B) for this study (Dun and Bradstreet, 1993). The data were supplied by Canadian 4-digit SIC (Standard Industrial Classification) code for each GTA region. These were aggregated into 2-digit SIC codes for preliminary calculations. They were eventually collapsed into the ten major SIC categories, used by Statistics Canada, which are:

- Primary
- Manufacturing
- Construction
- Transport, Communication and Utilities (TCU)
- Wholesale
- Retail
- Financial, Insurance and Real Estate (FIRE)
- Commercial Services
- Non-commercial Services
- Public Administration

The D&B information is collected through extensive telephone survey conducted annually. It is considered a representative snapshot rather than a comprehensive census of IC&I activity in a particular region. Employment totals provided by Hardy Stevenson and Associates (Hardy Stevenson and Associates, 1993) are considered more accurate. The D&B data provide a reasonable estimate of the distribution of employment across the various IC&I sectors.

Since the total number of employees reported by D&B was less than the total number of employees reported for each Region by Hardy Stevenson and Associates (Hardy Stevenson and Associates, 1993), the D&B totals were scaled up proportionately so that the Regional totals were in agreement. The employee data from Hardy Stevenson and Associates (Hardy Stevenson and Associates, 1993) are presented in Table 5.3. The number of employees in each major SIC code group as supplied by D&B, and modified for use in the present study, is presented in Table 5.5.

A number of IC&I waste generation and composition studies were reviewed (Gore & Storrie Ltd., 1991, RIS, CH2M Hill, KPMG, 1993, Proctor & Redfern, SENES Consultants Ltd., 1991, R.W. Beck & Associates, 1992, CH2M Hill, 1991, Matrix Management Group, 1988), some of these studies were conducted in southern Ontario. The generation rate data from these sources were combined to develop unit IC&I waste generation rates for each of the 2-digit

Table 5.5

Allocation of Employment to Ten Major SIC Groups in Each GTA Region, 1992

Major IC&I Group No.	Description	Employment											
		Durham		Halton		Metro Toronto		Peel		York		Total GTA	
		D&B	Revised Estimate	D&B	Revised Estimate	D&B	Revised Estimate	D&B	Revised Estimate	D&B	Revised Estimate	D&B	Revised Estimate
1	Primary	757	1,806	1,471	1,651	6,673	7,541	1,978	2,801	1,668	2,155	12,547	15,954
2	Manufacturing	21,381	51,006	32,282	36,224	204,972	231,632	98,927	140,104	53,535	69,166	411,097	528,133
3	Construction	4,840	11,546	6,037	6,774	52,186	58,974	16,724	23,685	24,259	31,342	104,046	132,322
4	TCU	5,174	12,343	4,200	4,713	64,204	72,555	20,239	28,663	9,220	11,912	103,037	130,186
5	Wholesale	6,077	14,497	10,159	11,400	90,713	102,512	45,223	64,047	32,130	41,511	184,302	233,967
6	Retail	9,404	22,434	10,707	12,015	88,233	99,709	23,939	33,903	17,713	22,885	149,996	190,946
7	FIRE	1,939	4,626	40,938	45,937	351,131	396,802	21,244	30,087	11,450	14,793	426,702	492,244
8	Non-Commercial	6,031	14,387	6,867	7,706	147,373	166,541	17,525	24,820	20,991	27,120	198,787	240,574
9	Commercial	11,362	27,105	15,269	17,134	224,666	253,888	36,223	51,300	27,880	36,021	315,400	385,447
10	Public Administration	7,067	16,859	9,509	10,670	65,793	74,351	3,731	5,284	3,675	4,748	89,775	111,912
	Total (All)	74,032	176,609	137,439	154,223	1,295,944	1,464,504	285,753	404,695	202,521	261,654	1,995,689	2,461,685

1) D&B refers to 1992 employment data provided to Hardy Stevenson Associates by Compusearch. This information was obtained from Dun & Bradstreet

2) "Revised Estimate" refers to the pro-rated scaled up totals by major SIC group, to reach the reported 1992 employment in each Region for 1992 (Hardy Stevenson Associates, 1993)

SIC groups expressed as tonnes/employee/year. The unit rates were used as a measure of the relative contribution of different industry sectors to IC&I waste generation in each region. The unit rates were calibrated for each Region using the estimated quantity of IC&I waste generated in 1992 (excluding construction and demolition waste). IC&I waste generation in 1992 was estimated for each region by multiplying the unit generation rate used for IC&I waste projections (discussed in section 5.2) by the estimated regional employment for 1992 (presented in Table 5.3).

The employment data and re-calibrated unit waste generation data at the 2-digit SIC level were combined to estimate average per employee waste generation rates for each of the 9 major SIC groups (excluding Construction). Unit waste generation rates estimated for each major SIC group in each GTA region are presented in Table 5.6.

The overall unit generation rates are different in each region because of the different employment mix in each region. Also, the unit generation rates within the same sector are different in each Region because of the different activities and employment mix within the major SIC grouping in each region. Estimated unit generation rates vary from 0.1 tonnes per employee per year for the finance/insurance real estate sector in Halton to 1.85 tonnes per employee per year in the manufacturing sector in Metro Toronto.

In general, the table shows that the largest per employee waste generating activity occurs in the manufacturing sector and the lowest in the financial/insurance/real estate sector across all regions. The wholesale and retail sectors also have relatively high unit waste generation rates.

In most sectors Metro Toronto has the highest unit generation rate while Durham has the lowest rate in every case (Region of Halton rates are low, but are considered underestimates because of limited availability of data at the time this work was carried out). York Region also has higher unit generation rates.

5.3.4. Application of Waste Allocation Method Using 1992 Theoretical Waste Generation Estimate

Total IC&I waste generation in GTA in 1992 was estimated to be approximately 2.885 million tonnes. This is the quantity that would have been generated if 1992 were a typical year. The recession may have had a significant impact on actual generation, which can not be measured accurately because of export and because there is no comprehensive method of compiling data on all waste diversion activities. However, the calculation is presented for illustrative purposes, using 1992 as a basis, as it is the year for which the best employment breakdown is available with which to carry out a waste allocation exercise.

Table 5.6

Estimated Unit Waste Generation Rates (tonnes/employee/yr) For the Nine Major Sector Groups By GTA Region, 1992

Major SIC	Description	Unit Waste Generation Rates (tonnes/employee/year)				
		Durham	Halton**	Metro Toronto	Peel	York
1	Primary	0.32	0.30	1.25	0.86	0.54
2	Manufacturing	1.41	0.92	1.85	1.43	1.80
3	Construction	*	*	*	*	*
4	TCU	0.73	0.56	1.04	1.10	1.30
5	Wholesale	1.10	0.77	1.52	1.27	1.60
6	Retail	0.98	0.72	1.40	0.89	1.48
7	FIRE	0.17	0.10	0.23	0.18	0.23
8	Non-Commercial	0.84	0.58	0.93	0.79	0.71
9	Commercial	0.81	0.55	0.96	0.87	1.09
10	Public Administration	0.21	0.16	0.32	0.27	0.29
	Overall	1.13	0.71	1.09	1.40	1.58

Notes:
* Construction & demolition waste is estimated separately as a percentage of the IC&I waste stream
** Halton rates considered underestimates, because complete data not available at time of preparation.

Based on typical data for construction and demolition waste in GTA, total C&D wastes make up approximately 21% of the total IC&I waste generated. C&D waste quantities for each region in GTA in 1992 were calculated using the reported data on C&D quantities as a percentage of total waste landfilled. C&D waste quantities for the regions of Durham, York and Metro Toronto were estimated using the reported data on C&D quantities as a percentage of total waste landfilled (Metro Works Department, 1990). For Peel Region, the quantity of C&D waste disposed was provided by Peel Regional staff (Morgan-Fraser L., Region of Peel, 1993). For Region of Halton, C&D waste was assumed to be the same percentage of total waste as in Peel for lack of other data. Table 5.7 summarizes the estimated C&D waste generated by each GTA Region in 1992. These data were used to estimate the proportion of the waste stream which would have been C&D waste if 1992 had been a typical year. Because of the severe economic slowdown, it is likely that the actual total was lower than this figure.

The estimated C&D quantities (approximately 610,000 tonnes) were then subtracted from the theoretical total IC&I waste generated in 1992 (approximately 2.885 million tonnes) to calculate waste generation in all other sectors.

The remaining 2.275 million tonnes were then allocated to the nine major SIC groupings by the method described earlier.

Initial calculations of IC&I waste generation were developed on a regional basis for GTA. For each two-digit SIC in each GTA region, the total quantity of waste generated was calculated by combining the unit generation rate and regional employment data for the sector.

Tables 5.8 shows the allocation of estimated 1992 IC&I waste generation to the nine major IC&I sectors in the GTA. It is estimated that the major IC&I groups contribute the following proportions of the estimated total IC&I waste generation in GTA:

• Primary	0.5%
• Manufacturing	29.8%
• Construction & Demolition	21.0%
• Transport, Communication and Utilities (TCU)	4.6%
• Wholesale	11.4%
• Retail	8.1%
• Financial, Insurance and Real Estate (FIRE)	3.7%
• Commercial Services	7.3%
• Non-commercial Services	12.4%
• Public Administration	1.1%

TABLE 5.7

Estimate of C&D Waste Generation for Each GTA Region, 1992

Region	C&D % of Total Waste (Note 1)	C&D % of IC&I Waste	Total IC&I Waste (tonnes)	Estimated C&D Waste (tonnes) 1992
Durham	13.15	21.04	199,568	41,989
Halton	16.84	32.0	109,498	35,040
Metro	10.32	17.25	1,596,309	275,363
Peel	16.84	26.3	566,573	149,009
York	17.87	26.2	413,413	108,314
Overall		21.13	2,885,315	609,715

Notes:

1. Data for Durham, Metro and York were taken from the *1990 Solid Waste Type and Source Area Declaration Summary Report* published by the Metro Works Department; 1987 C&D waste quantity for Peel was provided by Peel Regional staff (Morgan-Fraser, 1993); Halton was assumed to be the same as Peel for lack of available data
2. Totals may not add exactly from Regional totals due to round-off errors

Table 5.8

Estimated Allocation of IC&I Waste Generation to Major IC&I Groups in GTA Regions, 1992

Major SIC	Sector Description	Waste Generation Rates (tonnes/year)					
		Durham	Halton	Metro Toronto	Peel	York	GTA Total
1	Primary	576	495	9,437	2,401	1,165	14,074
2	Manufacturing	71,842	33,480	429,421	200,924	124,713	860,379
4	TCU	8,965	2,650	75,114	31,570	15,526	133,823
5	Wholesale	15,931	8,826	155,745	81,213	66,512	328,228
6	Retail	22,006	8,645	139,608	30,294	33,941	234,494
7	FIRE	780	4,775	90,942	5,531	3,447	105,475
8	Non-Commercial	12,075	4,502	154,191	19,557	19,243	209,567
9	Commercial	21,939	9,396	242,981	44,622	39,183	358,121
10	Public Administration	3,461	1,690	23,478	1,447	1,365	31,442
	Total IC&I	157,574	74,457	1,320,918	417,559	305,094	2,275,603

Note C & D waste was estimated separately as a percentage of the IC&I waste stream

It should be stressed that these estimates are for waste generated by different IC&I sectors. The quantity diverted through reduction, reuse and recycling will vary from one sector to another.

5.4 IC&I Waste Composition Estimates

5.4.1. Waste Categories Used

The composition of the GTA IC&I waste stream was estimated using the following categories:

- Old Corrugated Cardboard (OCC)
- Old Newsprint (ONP)
- Mixed Paper (note: in some cases fine paper fractions have been identified)
- Glass
- Ferrous Metal
- Non-ferrous Metal
- High-density Polyethylene (HDPE)
- Polyethtylene Terephthalate (PET)
- Other Plastics
- Food Wastes
- Yard Wastes
- Wood
- Construction and Demolition (C&D) Wastes (note: in some cases various components in the C&D waste stream have been identified)
- Other Wastes

These categories are different to those used for the residential sector because the relative quantities of some materials generated in the IC&I sector differ significantly from the residential sector.

Studies in Ontario, including GTA (Gore & Storrie Ltd., 1991, Jacob M., 1993, Proctor & Redfern, SENES, 1991), have shown that food wastes are generated in much greater quantities by the IC&I sector than yard waste. Therefore, this has been reflected by adjusting the relative amounts of food and yard waste in many sectors while leaving the combined composition of organics the same.

C&D composition data were taken from Solid Waste Environmental Assessment Plan (SWEAP) Discussion Paper No. 4.3, January 1991 (Proctor & Redfern, SENES Consultants Ltd., 1991). Table 5.9 shows the assumed C&D waste composition for the construction and demolition sectors in this study.

Table 5.9

Estimated Composition of C&D Waste in Greater Toronto Area

Material	Average Construction Waste Composition (%)	Average Demolition Waste Composition
Brick	0.4%	1.0%
OCC	4.5%	—
Concrete	6.9%	3.4%
Drywall	8.9%	—
Steel	7.9%	4.7%
Wood	30.6%	51.8%
Other	41.8%	39.1%
Fill & Aggr	12.8%	13.7%
Asphalt	3.4%	4.2%
Glass	3.5%	
Shingles	3.5%	1.0%
Total	100%	100%

Source: Proctor & Redfern, SENES Consultants Ltd., Solid Waste Environmental Assessment Plan (SWEAP) Discussion Paper No. 4.3, January 1991.

5.4.2. Waste Composition Estimates and Results

For each material category, except C&D (handled separately), composition is expressed as a percentage of the total waste stream from a given sector.

Waste composition data were compiled for each sector at the two-digit SIC level from a number of published reports (Gore and Storrie, 1991, Jacob. M., 1993, Proctor & Redfern and SENES, 1991, RIS, CH2M Hill, KPMG, 1993). These were used to estimate the quantity and composition of waste generated by each 2-digit SIC group in each GTA region. The quantities of each material generated were summed within each of nine major sector groups. For each region, these estimates of waste composition by major IC&I group are shown in Schedule N.

Table 5.10 summarizes the estimated quantities of each material generated within each of the nine major IC&I groups in GTA. The estimated quantities of each material generated in GTA also are shown. The table shows that the GTA IC&I waste stream generated is estimated to have the following composition (excluding C&D waste):

- paper (mixed plus newspaper) 28.1%
- OCC 15.7%
- metals (8.4% ferrous, 5.1% non-ferrous) 13.5%
- plastics 10.9%
- glass 3.3%
- wood 10.0%
- food and yard 9.7%
- all "other" 8.8%

Overall IC&I waste composition (including C&D waste) is estimated as follows:

- paper (mixed plus newspaper) 22.1%
- OCC 12.4%
- metals (6.7% ferrous, 4.0% non-ferrous) 10.7%
- plastics 8.6%
- glass 2.6%
- wood 7.9%
- food and yard 7.7%
- all "other" 6.9%

Table 5.10

Estimated IC&I Waste Generation and Composition
By Major IC&I Sector in GTA, 1992

Major SIC	Description		Waste Composition (tonnes)													
			OCC	ONP	Mixed P	Glass	Ferrous	Non-Ferr	HDPE	PET	Plastic	Food	Yard	Wood	Other	Total
1	Primary	%	15.67%	0.00%	7.62%	0.00%	18.96%	12.74%	0.00%	0.00%	2.29%	0.00%	0.00%	20.18%	22.53%	100.00%
		tonnes	2,205	0	1,073	0	2,669	1,792	0	0	323	0	0	2,840	3,172	14,074
2	Manufacturing	%	13.96%	2.92%	20.65%	1.92%	11.52%	5.88%	0.25%	0.05%	9.09%	4.62%	0.64%	15.85%	12.64%	100.00%
		tonnes	120,118	25,165	177,683	16,477	99,142	50,550	2,153	455	78,217	39,744	5,519	136,406	108,749	860,379
4	TCU	%	14.09%	6.00%	25.39%	3.49%	15.78%	11.97%	1.01%	0.41%	11.66%	2.17%	0.33%	3.40%	4.31%	100.00%
		tonnes	18,851	8,024	33,974	4,672	21,111	16,020	1,356	555	15,603	2,903	444	4,547	5,764	133,823
5	Wholesale	%	27.00%	1.00%	11.50%	0.80%	3.67%	2.17%	0.00%	0.00%	16.70%	5.00%	0.80%	22.00%	9.37%	100.00%
		tonnes	88,621	3,282	37,746	2,626	12,030	7,111	0	0	54,814	16,411	2,626	72,210	30,749	328,228
6	Retail	%	24.51%	11.37%	28.39%	3.69%	2.73%	0.35%	5.87%	0.10%	4.89%	11.89%	0.74%	1.42%	4.06%	100.00%
		tonnes	57,475	26,660	66,561	8,664	6,391	827	13,775	232	11,460	27,885	1,729	3,323	9,511	234,494
7	FIRE	%	8.56%	2.04%	54.51%	3.98%	1.81%	1.29%	1.72%	0.85%	8.67%	7.91%	0.28%	0.77%	7.62%	100.00%
		tonnes	9,030	2,150	57,498	4,197	1,908	1,363	1,809	893	9,147	8,340	294	810	8,036	105,475
8	Non-Commercial	%	6.70%	4.94%	30.00%	1.91%	11.06%	11.49%	0.23%	0.12%	10.01%	10.00%	6.58%	1.17%	5.79%	100.00%
		tonnes	14,047	10,347	62,870	3,998	23,184	24,077	491	246	20,977	20,957	13,789	2,456	12,129	209,567
9	Commercial	%	12.06%	3.35%	28.39%	9.38%	6.80%	3.89%	2.80%	0.72%	5.90%	21.61%	0.70%	1.27%	3.11%	100.00%
		tonnes	43,188	11,992	101,661	33,593	24,356	13,932	10,032	2,586	21,146	77,393	2,523	4,566	11,153	358,121
10	Public Administration	%	10.00%	0.00%	38.00%	5.00%	3.00%	1.58%	0.00%	0.00%	7.00%	2.00%	0.00%	0.00%	33.42%	100.00%
		tonnes	3,144	0	11,948	1,572	943	498	0	0	2,201	629	0	0	10,507	31,442
	All Sectors	tonnes	356,681	87,620	551,014	75,799	191,735	116,171	29,616	4,966	213,888	194,262	26,924	227,158	199,771	2,275,603
		%	15.67%	3.85%	24.21%	3.33%	8.43%	5.11%	1.30%	0.22%	9.40%	8.54%	1.18%	9.98%	8.78%	100.00%

5.5 References

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6.0 IC&I SYSTEM WASTE DIVERSION ESTIMATES

6.1 Introduction

Diversion estimates were developed for six IC&I waste diversion systems for the GTA. These systems are as follows:

IC&I System 1	Existing
IC&I System 2	Existing/Committed
IC&I System 3	Extended 3Rs Regulations
IC&I System 4	Expanded 3Rs Regulations
IC&I System 5	Expanded 3Rs Regulations with organics
IC&I System 6	No unprocessed waste to landfill

Chapter 2 of this report describes how these systems were developed. Note that IC&I Systems 3-5 are generally referred by abbreviated titles of "Extended 3Rs", "Expanded 3Rs" and "Expanded 3Rs with organics" respectively.

Section 6.2 of this chapter describes each of these systems. Section 6.3 describes how the diversion estimates for each system were developed.

6.2 IC&I System Descriptions

IC&I System 1 - Existing

This system is based on the IC&I waste management system which was in place in GTA at the end of December 1992. At that time, waste diversion by the IC&I sector was carried out on a voluntary basis. Tipping fees at GTA landfills were $150/tonne for the private sector, causing significant export of waste to the US. A number of landfill bans throughout the GTA also limited the materials which could be disposed in landfills (e.g. wood, tires, drywall, scrap metal, white goods, fine paper etc.).

Opportunities to recycle were provided to small IC&I generators through some municipally run depots. Two municipalities (Caledon and City of Toronto) provided some municipal collection of IC&I recyclables. Processing of some IC&I recyclables was also provided by some municipally-run MRFs.

Collection and processing of a wide range of source separated dry recyclables from the IC&I sector was provided by many private sector haulers and recyclers, some of which owned and operated processing facilities.

Collection and processing of wet wastes generated by the IC&I sector was provided by the private sector (e.g. centralized windrow composting - Scotts Farm, rendering of food wastes, collection by farmers for landspreading and animal feed, etc.). In addition, redistribution of food wastes from the IC&I

sector was carried out through organizations such as Second Harvest and food banks.

Various facilities provided exchange services (e.g. Ontario Waste Exchange, local waste exchange program in Durham, WASTEWISE, Halton, etc.)

Voluntary waste reduction initiatives were pursued by individual IC&I establishments. These include implementation of source separation and recycling programs, carrying out waste audits, and developing waste reduction action plans, which included reduction, reuse and recycling elements.

The National Packaging Protocol (NAPP), a federal initiative, required that packaging waste generation be reduced by 50% by the year 2000, measured against a 1988 baseline. NAPP is a voluntary program at this time. Private sector companies were complying with the spirit of NAPP on a voluntary basis as of the end of 1992.

IC&I System 2 - Existing/Committed

The Existing/Committed System includes the Existing System described above, and also the estimated impacts of any policy commitments announced at the local, regional, provincial and federal level by the end of 1992. These include the Ontario 3Rs regulations, and the National Packaging Protocol (NAPP).

The draft text of the Ontario 3Rs regulations was released in April, 1993. It was anticipated that the Ontario 3Rs regulations would be promulgated under the Environmental Protection Act in August of 1993, however, this schedule has been delayed. There are three requirements under the Ontario 3Rs regulations (Ministry of Environment and Energy, April 29, 1993). Designated major generators must:

- implement source separation programs
- carry out waste audits and develop waste reduction action plans
- some manufacturing facilities and importers must carry out packaging audits and develop packaging reduction action plans.

GTA IC&I facilities affected will have 6 to 12 months from the date of promulgation of the 3Rs regulations in which to comply.

Designated Major Waste Generators

The 3Rs regulations will apply only to those IC&I establishments which are designated major waste generators. These include:

- retail shopping establishments with a floor area of at least 10,000 sq. m.;
- retail shopping complexes with a floor area of at least 10,000 sq. m.;
- construction projects with a total floor area of at least 2,000 sq. m.;
- demolition projects with a total floor area of at least 2,000 sq. m.;
- office buildings with a total floor area of at least 10,000 sq. m.;
- multi-family complexes containing 6 or more units;
- restaurants with 10 or more employees;
- hotels and motels which have 75 units or more;
- hospitals classified as A, B, or F in Regulation 964;
- educational facilities with enrollment of 350 persons or greater;
- manufacturing facilities with 100 employees or more.

Source Separation Requirements

The regulations require that designated major generators of IC&I waste implement a source separation program covering a number of materials from the waste stream. Collection, handling and storage facilities must be provided for the materials specified. The generator must make reasonable efforts to ensure that source separated materials are reused or recycled.

The list of materials that is required to be separated varies among the different sectors, and is as follows:

Retail, office buildings, hospitals, educational	Restaurants, hotels and motels
• aluminum food and beverage cans • corrugated cardboard • fine paper • glass bottles and jars for food and beverages • newsprint • steel food and beverage cans	• aluminum food and beverage cans • corrugated cardboard • fine paper • glass bottles and jars for food and beverages • newsprint • steel food and beverage cans • PET
Multi-unit residential	**Large manufacturing**
• aluminum food and beverage cans • glass bottles and jars for food and beverages • newsprint • steel food and beverage cans • PET • other materials collected by local Blue Box program	• aluminum • corrugated cardboard • fine paper • glass • newsprint • steel • PET • HDPE, (jugs, crates, pails, totes and drums) • LDPE film • polystyrene foam • polystyrene trays, reels and spools • wood
Construction	**Demolition**
• brick • corrugate cardboard • concrete • drywall • steel • wood	• brick • concrete • steel • wood

Waste Audits and Waste Reduction Workplans

The designated major generators must also carry out waste audits and develop waste reduction action plans. These must be updated on a yearly basis, and be communicated to employees.

Packaging Audits and Packaging Reduction Workplans

Under the regulations, large manufacturers of food, beverages, paper and chemical products (in SIC 10, 11, 27, and 37) with greater than 100 employees, and importers of these products with annual sales in excess of $20 million must carry out packaging audits and develop packaging reduction workplans. These must be done at least every two years. They must be summarized and communicated to employees.

Discussions with haulers and recyclers suggest that the existing infrastructure in GTA will be able to handle the increased quantities of source separated materials requiring collection and processing under the requirements of the 3Rs regulations. Private sector haulers and recyclers are expected to be able to provide the increased services required. Existing processing capacity can likely handle the increased flow of materials, hence no new processing facilities are likely to be required.

IC&I System 3 - Extended 3Rs Regulations

This system would build on System 2, but would require a change in policy to extend the proposed 3Rs regulations to include a significantly larger number of IC&I waste generators.

In this system the proposed 3Rs regulations would be extended as follows:

- the waste related requirements of the 3Rs regulations (on source separation of (OCC, ONP, fine paper, glass, ferrous and non-ferrous metals), and also on mandatory waste auditing and waste reduction planning would be extended to cover all IC&I generators who account for 90% of the IC&I waste generated in Ontario (or the GTA);

- IC&I generators who account for 90% of the IC&I waste generated within the manufacturing, retail and wholesale sectors in Ontario (or the GTA) would be required to source separate an expanded list of materials (required only of major manufacturers in the current 3Rs regulations). The expanded list would include: aluminum, OCC, fine paper, glass ONP, steel, PET, HDPE, LDPE film, polystyrene and wood. Mandatory waste auditing and waste reduction planning would also be required of these generators;

- the proposed requirements for source separation (of brick, OCC, concrete, drywall, steel and wood), and waste reduction action plan development would also extend to a much larger number of

construction/demolition projects. Again, the cut off criterion would be chosen so that 90% of generated C&D waste would be subject to the regulations. It is estimated that these requirements would result in many smaller construction and demolition contractors having to comply with the regulations on smaller construction and demolition projects;

- in addition, food service and accommodation establishments would also be required to source separate PET;

- the packaging provisions in the 3Rs regulations would remain unchanged, and would apply only to major generators (>100 employees) in the SICs currently involved. (SIC 10, 11, 27 and 37) and importers of these products (with annual sales in excess of $20 million).

It has been assumed that 60-70% of IC&I generators likely account for 90% of IC&I waste generated in Ontario. Choosing the 90% cut-off for extension of the regulations is estimated to relieve many small IC&I generators of the requirements of the extended regulations. If 100% of all IC&I generators were required to comply with the extended regulations, it would require significant effort on the part of many very small IC&I establishments, with marginal benefit in terms of increased waste diversion. Capturing 90% of the waste stream under the extended regulations is considered a more appropriate approach. This is similar to the municipal 3Rs regulations, where requiring communities with populations over 5,000 to source separate provided recycling services to 90% of Ontario's population.

Each of the IC&I generators impacted by the extended 3Rs regulations would be required to institute source separation programs in their facilities. This would likely require the purchase of a number of recycling bins by each IC&I generator, for placement at strategic locations throughout the facility. Design of a recycling system for the facility, and development of a training program for facility staff, in order that they understand which materials go into which bins, would also be required.

The extent to which materials would be source separated in the IC&I facility would depend on the hauler, or recycler which services the IC&I facility. Some companies require separation into a number of different streams (e.g. glass, metal, plastic, fine paper, OCC, etc.) whereas other hauling/recycling companies use a two bin system.

Because the total processing capacity of the existing private sector recycling system is not known (private sector companies contacted during this study were reluctant to divulge this information), it is unknown what expansions

would be necessary to provide the additional capacity required. Also, the existing capacity of the private sector to provide recycling services is not known accurately, therefore the level of expansion of collection services necessary to meet the requirements of the extended 3Rs regulations can not be accurately estimated. The private sector would likely respond to provide the additional services and processing capacity required under this system, and always indicate their willingness and desire to do so (OWMA). On this basis it is reasonable to assume that adequate capacity for source separated material collection and processing will be available in GTA.

An aggressive market development policy would be required to ensure that stable markets were created for the larger quantities of dry recyclables which would enter the secondary materials markets under this system. Market development policies which could be considered include: mandatory recycled content for a number of products (particularly packaging), mandatory purchasing specification development at all levels of government to create incentives for secondary material market development, support of green industries using secondary materials as feedstock, etc.

IC&I System 4 - Expanded 3Rs Regulations

This system would build on System 3 (Extended 3Rs Regulations), and would require the source separation of a larger range of dry materials. System 4 would apply to IC&I generators who contribute to generation of 90% of the GTA (or Ontario) waste stream (the same group as for System 3) who would also be subject to the expanded 3Rs regulations. Identification of generators which would be involved was not carried out as part of this study, but it would likely apply to 60 to 70% of GTA generators. The Extended 3Rs Regulations system would require that the generators impacted source separate the following materials: aluminum, OCC, fine paper, glass, newsprint, steel, PET, HDPE, LDPE film, polystyrene, wood, and other paper products (which include boxboard and mixed papers).

The existing 3Rs infrastructure would likely require some expansion to handle the new materials which would be recycled under this system. Some new facilities (MRFs to handle a wide array of dry recyclables) and additional collection capacity (for dry recyclables) would be required. The additional plastics recovered in this system will require initiatives to encourage the development of cost effective separation and processing technologies.

This system would also require aggressive market development policies and actions to ensure that stable markets are created for the larger quantities of dry recyclables which would enter the secondary materials markets.

IC&I System 5 - Expanded 3Rs Regulations with Organics

This system would build on Systems 4 (Expanded 3Rs Regulations), and would include wet wastes, or organics (7-8% of the GTA IC&I waste stream) in the regulated list of materials requiring source separation by the IC&I sector. Because most IC&I food wastes are generated by a few IC&I sectors (most notably food manufacturers, grocery stores, restaurants, hotels, hospitals, schools, etc.) the regulations would be structured to capture 90% of the IC&I organic waste stream, by targeting a few sectors. In addition, significant IC&I generators of yard waste (landscapers, garden maintenance companies, etc.) would be required to source separate and divert these streams from disposal.

Many IC&I food waste generators would have to implement source separation programs for food wastes. New recycling bins would have to be purchased and located strategically in kitchen and food preparation areas. Staff would be trained to put food waste into designated separate bins.

In many cases, a separate company (to the hauler/recycler used for dry recyclables) may handle the source separated organics, which will require frequent removal from the property, because of potential odour generation. Where feasible, efforts may be made to compost the source separated food wastes on site.

Options for food waste diversion include use as human food, animal feed, landspreading, rendering and composting. The use of food banks and organizations such as Second Harvest would likely increase, depending on any health department restrictions involved. Existing landspreading and animal feed capacity within a reasonable distance of GTA are fixed, and are not easily expanded. Rendering capacity can be expanded considerably, but may not be cost competitive with other management options. Existing composting capacity may be adequate, (depending on what proportion of the source separated waste was composted and whether some private sector facilities in the planning stages at this time will be constructed).

Source separation and diversion of organic (predominantly green) wastes by IC&I generators such as landscapers and garden maintenance companies is likely easier, as most of their waste is relatively homogeneous. Options in this case would be limited to direct land application or composting.

IC&I System 6 - No Unprocessed Waste to Landfill

This system would build on the Existing/Committed IC&I System, including the requirements of the currently proposed 3Rs regulations and would

require that all IC&I waste be processed prior to landfilling. New legislation mandating this requirement would be necessary, or the same result would be achieved if this requirement were included in the Certificate of Approval for GTA landfills.

There are a number of ways in which this system could and probably would operate. Major generators subject to the 3R's regulations would implement source separation programs. For wastes from other generators, haulers/recyclers would have the option of either requiring some level of source separation by their facility accounts, or picking up only one bin of mixed waste (garbage). The applicability of each approach might depend on the size of the account and the overall economics of extensive material separation versus disposing of all waste into one bin.

The level of processing carried out would depend on the wording of the regulations, and the economics of additional processing versus minimal processing and subsequent disposal from the haulers/recycler's point of view.

High processing and disposal costs might encourage increased source separation and negotiation of separate contracts for different materials on economic grounds. There are examples of this approach in the existing system, where companies source separate OCC and negotiate for its separate collection by brokers. Also, some food service facilities allow farmers to haul away source separated food wastes at zero or minimal costs.

A variety of methods would be used to meet the requirements of this system. The combinations would include some source separation, and some processing of mixed waste. It would likely require additional processing facilities in the GTA for both source separated and mixed IC&I wastes (including specialized facilities for C&D waste).

The costs of waste management would increase, particularly for companies who opt for disposing of mixed waste without any source separation.

6.3 Estimates of Waste Diversion Rates by the IC&I Existing System

6.3.1 Approach to Estimating Current Waste Diversion Levels

Determining current diversion levels achieved by the GTA IC&I sector is a difficult task. Unlike diversion in the residential sector, where data are maintained by local and regional municipalities, there are no central data sources maintained on diversion by the IC&I sector. IC&I waste management is carried out by the private sector, and there are currently no data reporting requirements in place.

The Ontario Waste Management Association (OWMA) conducted a survey of its membership in March, 1991 which estimated that the IC&I diversion rate for the GTA was 17.8% and was expected to reach 23.7% in September, 1991. A survey to be completed in late 1993 is being conducted to determine recycling levels for 1992, and will be the best source of available data from the Association (Crawford, 1993). The results of this survey will be used to refine the preliminary estimates presented in this section at a future date.

A number of approaches were used to estimate 1992 IC&I waste diversion activity in the GTA. These included:

- Literature search
- Survey of associations representing major IC&I sectors
- Survey of representative number of GTA recycling companies
- Survey of IC&I generators
- Telephone survey of GTA Regional staff
- Theoretical estimate based on assumed diversion rates for different materials

The results of some of these efforts are described in Schedule O are summarized below.

Literature Search

A literature search was conducted to collect any published data on diversion activity available at the regional or IC&I sector level. Very little information was identified through this effort, though some published studies were obtained with useful information. These include:

- MacViro Consultants Inc., "Preliminary Study of Construction and Demolition Waste Division Constraints and Opportunities", 1992.
- National Taskforce on Packaging, National Packaging Surveys, 1988 and 1990
- articles on specific recycling activities such as, <u>Glassmaker Reports Large Jump in Recovery Rates</u>, in Recycling Canada, Feb. 1993

Numerous case studies of successful IC&I waste diversion programs were identified. However the degree to which these efforts represented efforts by the industry as a whole could not be determined, therefore the information contained in the case studies was of limited applicability to this study.

Telephone Survey of GTA Regional staff

A telephone survey was conducted of regional staff in GTA to collect any data on current levels of recycling by the IC&I sector at the regional level. The results of this survey are presented in Schedule O. However, very little information was available and the results of this survey did not contribute to a clearer picture of recycling levels by each of the major IC&I sectors in GTA.

Survey of IC&I Sector Associations

The Study Team conducted a telephone survey of associations representing industrial and commercial groups in GTA in February and March, 1993. Since data on waste generation was allocated to ten major IC&I sectors, as detailed in Chapter 5, IC&I establishments and associations which represented each of these ten sectors were surveyed.

The results of this survey are presented in Schedule O. They indicate that 3Rs activity varies widely among all sectors. While some associations had information on the waste management practices of their membership, and some were even playing a role in promoting greater awareness, the information was generally very limited and was insufficient to gain a reliable picture of the current levels of recycling in the IC&I sector.

Survey of Recycling Companies

There are over 220 private sector companies providing a range of hauling, processing and marketing services for IC&I wastes in GTA (RCO, 1992). A complete listing of all IC&I recycling companies in GTA is available through the Recycling Council of Ontario (RCO, 1992). The general structure of the existing IC&I waste management system in GTA is presented in Schedule O.

A representative number (approximately 60 of the 220) of companies providing a range of hauling, processing and marketing services in GTA was selected for a survey to determine quantities of material handled in 1992 (the survey questionnaire is included in Schedule O) of the 60 companies targetted. 54 companies were reached, and 37 participated. Most private haulers and recyclers contacted were unwilling to divulge proprietary information concerning their operations and capacities, however, indications of recycling activity for some materials were provided. Information from two of the largest companies, 5 middle-level and 30 small hauling and recycling companies.

Of the 54 companies contacted 28 companies provided data on the tonnages of materials diverted in 1992. The 28 responding companies diverted an estimated 633,000 tonnes of waste in GTA in 1992. A similar number

provided information on the number of IC&I accounts handled in 1992. The total number of accounts handled by approximately 28 responding companies was approximately 14,000. Of the 54 companies contacted, 31 reported employing 860 people. Table O-1.2 in Schedule O.

Survey of IC&I Sector Generators

The Study Team also conducted a telephone survey of a number of the major IC&I sector generators in GTA in February and March, 1993. Establishments representing the ten major IC&I sector categories used in Chapter 5 were contacted.

The results of this survey are presented in Schedule O. More detailed information was obtained from individual generators than from the survey of associations. The IC&I generator survey indicated that awareness of potential opportunities for waste reduction and recycling is growing in the IC&I sector in GTA. Significant results have been achieved in virtually every sector. However, the survey indicates that the level of 3Rs activity varies widely among and within all sectors, so that effective organization and summary of the information to determine an average waste diversion rate by sector was not possible.

Theoretical Estimate of Diversion

Since the aforementioned surveys provided little information toward a comprehensive picture of the current levels of IC&I waste diversion in GTA, the Study Team used an approach which estimates diversion in GTA based on assumed diversion rates for different materials. Based on the limited information available from research to date, preliminary estimates of diversion were developed for each material category. Waste composition estimates presented in Chapter 5 were used for this task. This methodology, and the results obtained, are presented in Section 6.3.2

6.3.2 Theoretical Diversion Estimate for Existing IC&I System

The composition of the GTA IC&I waste stream was estimated using the following categories:

- Old Corrugated Cardboard (OCC)
- Old Newsprint (ONP)
- Mixed Paper (note: in some cases fine paper fractions have been identified)
- Glass
- Ferrous Metal

- Non-ferrous Metal
- High-density Polyethylene (HDPE)
- Polyethylene Terephthalate (PET)
- Other Plastics
- Food Wastes
- Yard Wastes
- Wood
- Construction and Demolition (C&D) Wastes (note: in some cases various components in the C&D waste stream have been identified)
- Other Wastes

These categories are different to those used for the residential sector because the relative quantities of some materials generated in the IC&I sector differ significantly from the residential sector.

The assumed diversion rates used for this analysis, expressed as percentage diverted for each material, are summarized in Table 6.1. The estimated quantities of each material diverted, in tonnes, are presented in Table 6.2. The rationale for these estimates is presented below.

It should be stressed that these percentages are best estimates of the current recycling activity based on information obtained from research to date. There is some uncertainty in these assumed diversion rates and further refinement of these estimates may be carried out, if additional applicable information is identified. An estimated overall diversion rate of between 25% and 32% is estimated for the Existing IC&I System, based on the assumptions used.

The assumptions used to estimate current diversion rates are discussed by material below.

- **OCC**: Old corrugated cardboard has one of the highest product recovery rates (primarily through the IC&I sector) (Apotheker, March 1993). NAPP reported that 61% of OCC packaging is recycled in Ontario (NAPP, 1990 Survey) and noted that 96% of paper packaging sent for recycling is OCC from all industry sectors (NAPP, 1990 Survey). An earlier NAPP study reported a 35% recycling rate of OCC (NAPP, 1988 survey). One end market source contacted by the Study Team thought an estimate of 60% was not unreasonable (confidential source). A US study by AIA in 1993, indicated that 70% of OCC recycled in the commercial and retail sectors, the largest users of OCC, is recycled by the largest generators (AIA, 1993). Since bans on disposal of OCC in landfills have been in place since 1989, a high diversion rate can be expected.

  Therefore, an initial estimate of 60%, representing an estimated 214,000 tonnes of OCC is assumed to have been diverted in GTA in

Table 6.1

Assumed Current Diversion Rate of IC&I Waste Stream By Material

Material	Assumed Current Diversion Rate (% of generated)
OCC	60%
ONP	15%
Fine Paper	75%
Mixed Paper	25%
Glass	18%
Ferrous	20%
Non-ferrous	20%
HDPE	5%
PET	7%
Other Plastics	5%
Food	1%
Yard	1%
Wood	50%
Other	10%
C&D	
— Brick	30%
— OCC	60%
— Concrete	30%
— Drywall	30%
— Steel	60%
— Wood	60%
— Other	5%

Note: All of the above estimates are based on limited available information, described in Section 6.3.2 by material, but are considered to provide a reasonable preliminary estimate of the potential range of the effects of the proposed 3Rs regulations and NAPP for the Existing/Committed IC&I System. Information on markets by material is presented in Schedule H of this document.

Table 6.2

Estimate of Diversion of IC & I Waste Under Existing System Greater Toronto Area

Waste Component	Estimated IC&I Waste Generated (tonnes) 1992 (column 1)	Estimated IC&I Diversion (tonnes) Existing 3R 1992 (column 2)	Estimated IC&I Diversion Rate (%) 1992	Estimated IC&I Waste Disposed (by difference) (tonnes) 1992	Estimated Composition of Disposed IC&I Waste (%) 1992
Total IC&I Waste (tonnes)	2,885,315				
Paper					
Newspaper	87,620	13,143	15%	74,477	4%
Corrugated cardboard (OCC)	356,681	214,009	60%	142,673	7%
Fine Paper		165,304			
Mixed paper (1)	551,014	82,652	45%	303,058	15%
Subtotal (Paper)	995,315	475,108	48%	520,207	26%
Glass	75,798	13,644	18%	62,155	3%
Ferrous	191,733	38,347	20%	153,387	8%
Non-ferrous	116,171	23,234	20%	92,937	5%
Subtotal (Metal)	307,904	61,581	20%	246,323	12%
Plastic					
PET	4,966	348	7%	4,618	0%
HDPE	29,617	1,481	5%	28,136	1%
Other Plastic	213,888	10,694	5%	203,193	10%
Subtotal (Plastic)	248,471	12,523	5%	235,948	12%
Organics					
Food wastes	194,262	1,943	1%	192,319	10%
Yard waste	26,923	269	1%	26,653	1%
Subtotal (Organics)	221,184	2,212	1%	218,972	11%
Wood Waste	227,158	113,579	50%	113,579	6%
Construction/Demolition Waste					
Brick,OCC,Conc,Drywl,Steel,Wood	366,133	200,840	55%	165,293	8%
Other	243,581	12,179	5%	231,402	12%
Subtotal (Organics)	609,714	213,019	35%	396,695	20%
Other	199,770	19,977	10%	179,793	9%
TOTAL	2,885,315	911,642	32%	1,973,673	100%

Notes:

1. Includes some fine paper of some sectors
2. All diversion estimates illustrated using assumed 1992 data.

1992.

- **Fine Paper**: The surveys carried out by the Study Team for this study indicate that a substantial number of recycling programs are in place in commercial and office establishments in GTA. Pitney Bowes conducted a survey of its customers in 1992 which showed that 72% of offices in Ontario have recycling programs (Pitney Bowes, 1992). Fine paper is a significant portion of that office waste (Gore & Storrie, 1991). Also, according to Franklin & Associates, in 1990 collection of fine paper from offices in the U.S. was estimated to be 16% of the available fine paper (Franklin & Associates, 1991). It is believed that in GTA the office recycling activity represents a higher concentration of office recycling programs and involves significant quantities of fine paper.

  Therefore, an estimate of a 75% recycling rate for fine paper has been assumed (this may be high and may be revised in future estimates). Based on available information on fine paper fractions of waste paper streams (Gore & Storrie, 1991), it is estimated fine paper represents roughly 40% of the mixed paper stream. It was estimated that approximately 220,400 tonnes of fine paper were generated in GTA in 1992. With an assumed recycling rate of 75%, roughly 165,300 tonnes of fine paper is estimated to have been recycled in GTA in 1992.

- **ONP**: Most ONP is generated by the residential sector. An estimated 40% of available ONP was recycled in Canada in 1991, and more than 50% of available supply was recovered in Ontario (CDNA, 1992). IC&I sector recycling of ONP is assumed to be significantly less. Pre-consumer sources in the IC&I sector have always been recycled. For post-consumer ONP recovery programs, such as that conducted by the Toronto Transit Commission (TTC, 1988), recovery is assumed to be low.

  Therefore, an initial estimate of 15%, representing approximately 13,000 tonnes of ONP, has been assumed to have been recycled in the IC&I sector in GTA in 1992.

- **Mixed Paper**: This category includes fine paper (factored out in this analysis since it is specifically targetted in the 3Rs regulations), various post-consumer boxboards, some post-consumer OMG, various Kraft used in packaging, envelopes, polycoat packaging and fibre cores. While the markets for these secondary materials may be growing with the introduction of new technology and greater demand for other secondary fibres such as ONP, markets still are

limited.

A number of the office recycling programs in GTA offered by private recycling companies (Laidlaw, Metro Waste Paper, WMI) collect a mixed paper stream. This would tend to increase the recycling levels of lower value fibres.

However, mixed paper is a broad category of waste fibres and includes materials such as fibre cores which have a high weight, and Kraft from various sources. These are expected to have significantly lower recycling rates but their contribution to the waste stream is not known at this time. NAPP noted that 96% of paper packaging sent for recycling is OCC from all industry sectors (NAPP, 1990 survey).

Therefore, an initial estimate of 25%, representing roughly 82,000 tonnes of mixed paper (other than fine paper, OCC and ONP) has been assumed to have been diverted in GTA in 1992 (this may be high).

- **Glass**: Consumers Glass of Etobicoke estimates that 324,500 tons of glass cullet is available in Ontario, of which 80% is residential, and 20% IC & I (64,900 tonnes) (Paradiso, 1993). Consumers Glass also estimated that it recovered approximately 5,620 tonnes of glass from IC&I programs in Ontario in 1991 (Recycling Canada, 1993).

  NAPP in its 1988 survey report noted a glass diversion rate of 19% (NAPP, 1988 survey). In its 1990 survey, NAPP indicated a high reuse rate of glass containers (approximately 60%). This reuse is assumed to be largely beer and soft drink containers which would not appear in the waste generation estimates of this study. The NAPP report also showed a national recycling rate of approximately 15% to 20% of glass not reused. For Ontario, a 22% to 27% recycling rate of glass containers is indicated (NAPP, 1990 Survey).

  At this time reliable information on recycling of other types of glass materials in the IC&I sector, such as plate glass, is not available.

  Therefore, an initial estimate of 18%, representing approximately 13,600 tonnes of glass has been assumed to have been diverted in GTA in 1992.

- **Plastic**: Plastics currently have very limited markets for a number of reasons, including identification and sorting problems, contamination by materials other than plastic resins, and high

transportation costs due to the low density of plastics.

The majority of film plastics are landfilled (Horn, 1993, Rafferty, 1993). Recycling of HDPE is usually profitable, but is not profitable at this time due to low market demand (Riddell, 1993).

PET has a significantly higher value than other plastics and is generally sorted from mixed plastics streams. However, PET generally is not used in high volumes in the IC&I sector. It likely would be collected under mixed material programs particularly from institutions such as hospitals and schools.

High volume, homogeneous, pre-consumer scrap plastics are assumed to have been recycled for some time and therefore are a smaller part of the waste generation estimates in this study.

NAPP, in its 1988 survey report, noted a plastics recycling rate of 7%. In the 1990 survey, NAPP indicates an overall plastics recycling rate of approximately 8% to 10%. In Ontario, reported plastics recycling varies from 1% to approximately 50%, depending on the packaging group.

Therefore, for this analysis, it is assumed that overall plastic recycling rates currently are low in the IC&I sector, and initial estimates of recycle rates for plastics have been made based on the following assumptions:

— PET 7% (this may be low)
— HDPE 5% (this may be low)
— Other plastics 5% (this may be high: 1% to 2% may be more realistic)

- **Metals:**

Ferrous: It is assumed that high volume homogeneous scrap metals have been recycled for some time and do not appear in significant portions in the waste generation estimates of this study. Tinplate steel recycling also is a well-established practice. However, the Canadian Steel Can Recycling Council (Paulowich, 1993) reported that available tonnages in the province are unknown, and so recycling rates of tinplate steel are uncertain. It is estimated though that in Ontario, the steel can recycling rate is approximately 70%.

NAPP reports that recycling varied between 19% and 70%, depending on the packaging group. Overall, a recycling rate of about 30% and a reuse rate of roughly 20% is indicated (NAPP, 1990

survey).

NAPP also indicates a disposal rate of 279,000 tonnes in Ontario for ferrous metal from packaging group 78 (strapping/wire), which represents a significant portion of the 444,000 tonnes of ferrous metals packaging reported used (NAPP, 1988 survey). In the same survey, a 19% diversion rate is indicated for ferrous metals. It is assumed that other containers such as paint cans which are heavy gauge, may constitute a significant portion of the waste stream that is not recycled.

An initial estimate of 20%, representing approximately 38,000 tonnes of ferrous metals, has been assumed to have been diverted in GTA in 1992 (this may be a low estimate).

Non-ferrous: NAPP indicates a 20% to 25% recycling rate in Canada for aluminum containers. In Ontario a 30% recycling rate is indicated (NAPP, 1990 survey). The reused containers would not appear in the waste generation figures in this analysis. Also, high volume non-ferrous scrap metals have been recycled for some time due to their high value, and similarly would not be represented in the waste generation estimates.

It was assumed that non-ferrous materials in durable goods may be a significant portion of the waste stream for certain sectors and are assumed to have a relatively low diversion rate.

An initial estimate of 20%, representing approximately 23,000 tonnes of non-ferrous metal was assumed to have been recycled in 1992.

- **Wood**: Most IC&I wood wastes are generated in the manufacturing and wholesale sectors. A significant portion of this was assumed to be wooden pallets, particularly in the wholesale sector. Increasingly these are reused and recycled. NAPP indicates a wood packaging recycling rate in Ontario of from 12% to 41% depending on the packaging group (40% for pallets, etc.), and a combined reuse and recycling rate overall in Canada of roughly 85% (NAPP, 1990 survey). Landfill bans on disposal of wood are expected to have had a significant impact on the diversion of wood waste by all sectors.

  Therefore, an initial estimate of 50%, representing roughly 113,600 tonnes of wood was assumed to have been recycled in GTA in 1992.

- **Organics:** Despite specific examples of food waste diversion in the IC&I sector from surveys, overall food waste recycling rates in the IC&I sector were assumed to be low. While there is significant potential for food and yard waste diversion, markets, handling and processing capacity are not highly developed in GTA.

  An initial estimate of 1% diversion of food waste has been assumed. This may be low as a number of large grocery stores and large restaurants have established food waste recycling programs. At this time reliable information on the proportion of the food waste stream that this represents is limited.

  Similarly, yard waste diversion has been estimated at 1% (this may be low given some municipal works programs and facilities for centralized yard waste processing).

- **C&D:** Landfill bans have encouraged diversion of homogeneous wastes generated by the C&D sector; each of the GTA regions have imposed landfill disposal bans on recyclable wood, recyclable drywall, cardboard, metals, concrete and rubble. As such, source separation of banned materials takes place at a number of construction sites. Over the years, C&D companies have achieved significant diversion of the quantity of waste going to landfill. For example, one major construction company has achieved a 50% diversion of waste going to landfill through source separation and on-site reuse applications (confidential source).

  MacViro estimated diversion of up to 48% of C&D wastes in a scenario of good economic activity in GTA and reduced export of wastes (this does not consider material historically diverted). This diversion estimate assumed that of the new diversion, 19% would be concrete, metals and other heavy materials, 53% would be clean drywall, OCC and wood, and 28% would be other mixed materials (MacViro, 1992).

  For this analysis, initial estimates of C&D recycling were as follows:

  - Brick 30% - may be low considering bans
  - OCC 60% - readily separated and recycled, good markets
  - Concrete 30% - may be low considering landfill bans
  - Drywall 30% - may be low, depending on recyclable content
  - Steel 60% - readily separated and recycled, good markets
  - Wood 60% - readily separated and recycled, good markets
  - Other 5% - may be low

Overall, diversion of 35%, representing an estimated 213,000 tonnes of C&D material has been assumed. This may be low, particularly for the aggregates. It may be revised upward in later analyses.

- **Other Materials**: This includes tires, textiles, bulky goods and other materials. It is difficult to estimate diversion of these materials because there is no accurate breakdown of the composition of this category. An initial estimate of 10% diversion of other materials is assumed.

From this approach it was estimated that overall, approximately 32%, or 912,000 tonnes of IC&I wastes could have been diverted in GTA in 1992. Total IC&I waste generation in 1992 is estimated at approximately 2.885 million tonnes, therefore, an estimated 2 million tonnes were disposed. Sensitivity analyses on some of these assumptions indicate that a lower bound to this estimate is approximately 25% diversion, or 720,000 tonnes in 1992.

6.4 Estimates of Waste Diversion by the Existing/Committed IC&I System

6.4.1 Approach to Waste Diversion Estimate

The Existing/Committed System includes the impacts of the proposed Ontario 3Rs Regulations, and also the impacts of NAPP. The unofficial text for the 3Rs regulations became available on 29 April, 1993. Preliminary estimates of their potential impact on diversion of IC&I waste in Greater Toronto Area were developed using 1992 waste generation values, for illustrative purposes.

The original intent of the 3Rs regulations (as laid out in Initiatives Paper No. 1) (MOE, 1991) was to eventually apply the source separation and 3Rs Regulations requirements to IC&I generators of all sizes. This intention does not appear in the final regulation text, therefore small (non-major) IC&I generators will not be required to source separate materials in the foreseeable future.

Preliminary estimates of the impact of the 3Rs regulations on IC&I sector waste generators considered what quantities of waste would be diverted if all IC&I waste generators were subject to the regulations.

Assumptions were then made on the number of establishments likely to be subject to the regulations, and also on the impacts of current voluntary compliance with the intent of the regulations, to estimate the incremental impacts of the Existing/Committed System.

At this time, the proportion of total IC&I waste in the Greater Toronto Area generated by "major" IC&I generators subject to the 3Rs regulations is not known. The Study Team attempted to obtain detailed information such as profiles of employment, retail space, office space, construction and demolition projects from many sources in order to refine this analysis. A summary of the contacts made is presented in Schedule 0.

Estimates of the impact on diversion if all generators were subject to the 3Rs regulations were developed. A rough preliminary assessment of how the number of establishments that are subject to the regulations affects diversion rates was made then carried out. A "coverage" factor was applied to the waste materials potentially diverted if all establishments were subject to the regulations. "Coverage" factors representing 20%, 40% and 60% of all IC&I generators were applied.

Tables 6.3, 6.4 and 6.5 summarize the estimates of diversion rates at these assumed levels of "coverage". The quantities of each material potentially diverted if all establishments are subject to the regulations are presented in column 3 of the Tables. The estimated potential incremental effects of the 3Rs Regulations are shown in column 4 of the Tables.

One of the limitations of this analysis is determining the "overlap" between companies which are currently recycling on a voluntary basis, and those which are designated as major generators and which will be required to conduct waste audits and develop waste reduction plans under the proposed 3Rs regulations. If all of those required to implement source separation programs currently are doing so, then the incremental effects of the 3Rs regulations would be zero, and waste diversion would remain at the current level, estimated to be 25% to 32%. This is unlikely to be the case. However, to determine the exact number of companies which are subject to the regulations, and the percentage of these which are currently meeting all of the requirements of the regulations. It is not possible without extensive research and survey activity which was beyond the scope of this study

It was assumed that voluntary recycling is currently occurring in both establishments that are designated "major generators" under the proposed 3Rs regulations and in those that are not designated as "major generators". A preliminary estimate of the distribution of this existing diversion was required to assess the incremental diversion likely under the Existing/Committed System. Since accurate and comprehensive information on current recycling activity overall is limited, and since there is no comprehensive analysis of the number of establishments (and the corresponding waste generated) which will be captured by the 3Rs regulations, it was very difficult to estimate how the current recycling activity is distributed among establishments of different sizes in the different sectors, which will or will not be subject to the 3Rs regulations.

Table 6.3
Estimate of Diversion of IC&I Waste
Under Existing/Committed System (20% capture)
Greater Toronto Area

Waste Component	Estimated IC&I Waste Generated (tonnes)	Estimated IC&I Diversion Existing 3R (tonnes)	Estimated IC&I Diversion - 3R (100% Coverage) (tonnes) (column 3)	Estimated IC&I Incr Diversion Exist/Com-3R (tonnes) (column 4)	Estimated IC&I Diversion - 100% NAPP/Pckg Aud. and other (tonnes) (column 5)	Estimated IC&I Incr Diversion NAPP/Pckg Aud and other (tonnes) (column 6)	Estimated IC&I Total Diversion (tonnes) (column 7)	Estimated IC&I Diversion Rate By Material (%)	Estimated IC&I Waste Disposed (by difference) (tonnes)	Estimated Composition of Disposed IC&I Waste (%)
Total IC&I Waste (tonnes)	2,885,315									
Paper										
Newspaper	87,620	13,143	80,327	5,551	0	0	18,694	21%	68,926	4%
Corrugated cardboard (OCC)	356,681	214,009	256,473	0	44,311	0	214,009	60%	142,673	7%
Fine Paper		165,304	203,163	0	0	0	165,304			
Mixed paper (1)	551,014	82,652	0	0	98,682	3,206	85,858	46%	299,852	16%
Subtotal (Paper)	995,315	475,108	539,963	5,551	142,993	3,206	483,865	49%	511,450	27%
Glass	75,798	13,644	70,837	3,252	1,313	0	16,896	22%	58,902	3%
Ferrous	191,733	38,347	166,479	2,618	6,016	0	40,965	21%	150,768	8%
Non-ferrous	116,171	23,234	99,259	1,264	4,400	0	24,499	21%	91,672	5%
Subtotal (Metal)	307,904	61,581	265,738	3,883	10,416	0	65,464	21%	242,441	13%
Plastic										
PET	4,966	348	1,633	153	1,668	1,494	1,995	40%	2,971	0%
HDPE	29,617	1,481	2,491	0	13,535	13,387	14,868	50%	14,749	1%
Other Plastic	213,888	10,694	41,060	2,865	27,408	1,204	14,763	7%	199,125	10%
Subtotal (Plastic)	248,471	12,523	45,184	3,018	42,611	16,085	31,625	13%	216,845	11%
Organics										
Food wastes	194,262	1,943	0	0	0	0	1,943	1%	192,319	10%
Yard waste	26,923	269	0	0	0	0	269	1%	26,653	1%
Subtotal (Organics)	221,184	2,212	0	0	0	0	2,212	1%	218,972	11%
Wood Waste	227,158	113,579	110,033	0	36,106	0	113,579	50%	113,579	6%
Construction/Demolition Waste										
Brick,OCC,Conc,Drywl,Steel,Wood	366,133	200,840	366,133	0	0	0	200,840	55%	165,293	9%
Other	243,581	12,179	0	0	0	0	12,179	5%	231,402	12%
Subtotal (Organics)	609,714	213,019	366,133	0	0	0	213,019	35%	396,695	21%
Other	199,770	19,977	0	0	39,950	19,973	39,950	20%	159,820	8%
TOTAL	2,885,315	911,642	1,397,888	15,704	273,389	39,264	966,610	34%	1,918,705	100%

Notes:
1. Includes some fine paper of some sectors
2. All diversion estimates illustrated using assumed 1992 data.

Table 6.4
Estimate of Diversion of IC&I Waste
Under Existing/Committed System (40% capture)
Greater Toronto Area

Waste Component	Estimated IC&I Waste Generated (tonnes)	Estimated IC&I Diversion Existing 3R (tonnes)	Estimated IC&I Diversion - 3R (100% Coverage) (tonnes) (column 3)	Estimated IC&I Incr Diversion Exist/Com-3R (tonnes) (column 4)	Estimated IC&I Diversion - 100% NAPP/Pckg Aud. and other (tonnes) (column 5)	Estimated IC&I Incr Diversion NAPP/Pckg Aud and other (tonnes) (column 6)	Estimated IC&I Total Diversion (tonnes) (column 7)	Estimated IC&I Diversion Rate By Material (%)	Estimated IC&I Waste Disposed (by difference) (tonnes)	Estimated Composition of Disposed IC&I Waste (%)
Total IC&I Waste (tonnes)	2,885,315									
Paper										
Newspaper	87,620	13,143	80,327	21,616	0	0	34,759	40%	52,860	3%
Corrugated cardboard (OCC)	356,681	214,009	256,473	0	44,311	0	214,009	60%	142,673	8%
Fine Paper		165,304	203,163	0	0	0	165,304			
Mixed paper (1)	551,014	82,652	0	0	98,682	22,942	105,594	49%	280,115	16%
Subtotal (Paper)	995,315	475,108	539,963	21,616	142,993	22,942	519,667	52%	475,648	27%
Glass	75,798	13,644	70,837	17,420	1,313	48	31,111	41%	44,687	3%
Ferrous	191,733	38,347	166,479	35,914	6,016	0	74,261	39%	117,473	7%
Non-ferrous	116,171	23,234	99,259	21,116	4,400	17	44,368	38%	71,803	4%
Subtotal (Metal)	307,904	61,581	265,738	57,031	10,416	17	118,629	39%	189,276	11%
Plastic										
PET	4,966	348	1,633	479	1,668	1,494	2,321	47%	2,645	0%
HDPE	29,617	1,481	2,491	0	13,535	13,387	14,868	50%	14,749	1%
Other Plastic	213,888	10,694	41,060	11,077	27,408	6,685	28,457	13%	185,431	10%
Subtotal (Plastic)	248,471	12,523	45,184	11,556	42,611	21,567	45,646	18%	202,825	11%
Organics										
Food wastes	194,262	1,943	0	0	0	0	1,943	1%	192,319	11%
Yard waste	26,923	269	0	0	0	0	269	1%	26,653	1%
Subtotal (Organics)	221,184	2,212	0	0	0	0	2,212	1%	218,972	12%
Wood Waste	227,158	113,579	110,033	0	36,106	0	113,579	50%	113,579	6%
Construction/Demolition Waste										
Brick,OCC,Conc,Drywl,Steel,Wood	366,133	200,840	366,133	16,890	0	0	217,730	59%	148,403	8%
Other	243,581	12,179	0	0	0	0	12,179	5%	231,402	13%
Subtotal (Organics)	609,714	213,019	366,133	16,890	0	0	229,910	38%	379,804	21%
Other	199,770	19,977	0	0	39,950	19,973	39,950	20%	159,820	9%
TOTAL	**2,885,315**	**911,642**	**1,397,888**	**124,513**	**273,389**	**64,547**	**1,100,703**	**38%**	**1,784,612**	**100%**

Notes:
1. Includes some fine paper of some sectors
2. All diversion estimates illustrated using assumed 1992 data.

Table 6.5
Estimate of Diversion of IC&I Waste
Under Existing/Committed System (60% Capture)
Greater Toronto Area

Waste Component	Estimated IC&I Waste Generated (tonnes)	Estimated IC&I Diversion Existing 3R (tonnes)	Estimated IC&I Diversion - 3R (100% Coverage) (tonnes) (column 3)	Estimated IC&I Incr Diversion Exist/Com-3R (tonnes) (column 4)	Estimated IC&I Diversion - 100% NAPP/Pckg Aud. and other (tonnes) (column 5)	Estimated IC&I Incr Diversion NAPP/Pckg Aud and other (tonnes) (column 6)	Estimated IC&I Total Diversion (tonnes) (column 7)	Estimated IC&I Diversion Rate By Material (%)	Estimated IC&I Waste Disposed (by difference) (tonnes)	Estimated Composition of Disposed IC&I Waste (%)
Total IC&I Waste (tonnes)	2,885,315									
Paper										
Newspaper	87,620	13,143	80,327	37,682	0	0	50,825	58%	36,795	2%
Corrugated cardboard (OCC)	356,681	214,009	256,473	16,918	44,311	0	230,927	65%	125,754	8%
Fine Paper		165,304	203,163	0	0	0	165,304			
Mixed paper (1)	551,014	82,652	0	0	98,682	42,679	125,331	53%	260,379	17%
Subtotal (Paper)	995,315	475,108	539,963	54,600	142,993	42,679	572,387	58%	422,928	27%
Glass	75,798	13,644	70,837	31,587	1,313	310	45,541	60%	30,257	2%
Ferrous	191,733	38,347	166,479	69,210	6,016	0	107,557	56%	84,177	5%
Non-ferrous	116,171	23,234	99,259	40,968	4,400	897	65,100	56%	51,071	3%
Subtotal (Metal)	307,904	61,581	265,738	110,178	10,416	897	172,656	56%	135,248	9%
Plastic										
PET	4,966	348	1,633	806	1,668	1,494	2,648	53%	2,318	0%
HDPE	29,617	1,481	2,491	162	13,535	13,387	15,030	51%	14,588	1%
Other Plastic	213,888	10,694	41,060	19,289	27,408	12,167	42,150	20%	171,738	11%
Subtotal (Plastic)	248,471	12,523	45,184	20,257	42,611	27,048	59,828	24%	188,643	12%
Organics										
Food wastes	194,262	1,943	0	0	0	0	1,943	1%	192,319	12%
Yard waste	26,923	269	0	0	0	0	269	1%	26,653	2%
Subtotal (Organics)	221,184	2,212	0	0	0	0	2,212	1%	218,972	14%
Wood Waste	227,158	113,579	110,033	9,230	36,106	0	122,809	54%	104,348	7%
Construction/Demolition Waste										
Brick,OCC,Conc,Drywl,Steel,Wood	366,133	200,840	366,133	90,117	0	0	290,957	79%	75,176	5%
Other	243,581	12,179	0	0	0	0	12,179	5%	231,402	15%
Subtotal (Organics)	609,714	213,019	366,133	90,117	0	0	303,136	50%	306,578	20%
Other	199,770	19,977	0	0	39,950	19,973	39,950	20%	159,820	10%
TOTAL	**2,885,315**	**911,642**	**1,397,888**	**315,969**	**273,389**	**90,908**	**1,318,519**	**46%**	**1,566,796**	**100%**

Notes:
1. Includes some fine paper of some sectors
2. All diversion estimates illustrated using assumed 1992 data.

Preliminary estimates have been made based on the assumptions that the majority of the materials recycled are generated by large establishments and, that more large establishments are recycling due to economies of scale. For example, a US study by AIA in 1993, indicated that 70% of OCC recycled in the commercial and retail sectors, is recycled by the largest generators (AIA, 1993). Further assumptions are presented below. Table 6.6 summarizes by sector the assumed distribution of existing recycling activities among IC&I establishments subject, and those not subject, to the 3Rs regulations, used for this analysis. These were used in estimating the effect of the 3R regulations on diversion presented in Tables 6.3, 6.4 and 6.5.

The distribution of existing recycling was held constant in the different cases of effective coverage (20%, 40% and 60%) tested since there was no reliable basis on which to assume different distributions in each case. In some cases at lower coverage levels it was estimated that all of the material subject to the regulations is currently being diverted.

6.4.2 Sector-specific Assumptions on which Existing/Committed IC&I System Diversion Estimates were Based

The following assumptions were used to estimate the quantities of material potentially affected in each sector if all generators were subject to the regulations:

- **IC&I** waste generation and composition for major IC&I groups 1, 2 and 4-10 are shown by region in Schedule N, and for the entire GTA, in Tables 5.8 and 5.10 in Chapter 5.

- **Fibres** waste composition data have been presented as OCC, ONP and Mixed Paper. Fine Paper is included in the 3Rs regulations and depending on the sector, is potentially subject to the regulations. Therefore, it was necessary to estimate the contribution of fine paper to the mixed paper waste stream. Information which exists on fine paper fractions of the "mixed paper" stream (Gore and Storrie, 1991) were applied to relevant sector groups to determine the quantities of fine paper generated by different IC&I sectors.

- **Primary**
  The primary sector is not generally subject to the regulations. However, mining and petrochemical industries in Metro likely would involve office activity which might be subject to the regulations (depending on the floor area of the office building). The quantities of wastes involved were assumed to be insignificant, and therefore were ignored in the preliminary estimates.

Table 6.6

Assumed Allocation of Current IC&I Recycling to Generators Subject and Not Subject to 3Rs Regulations

Waste Material	Assumed Current Recycling Rate	Assumed Allocation to Companies Subject to 3Rs	Assumed Allocation to Companies Not Subject to 3Rs (excluding wholesale)	Assumed Allocation to Wholesale Sector
OCC	60%	64%	20%	16%
ONP	15%	80%	20%	
Fine Paper	75%	80%	20%	
Mixed Paper	25%	80%	15%	5%
Glass	18%	80%	16.5%	3.5%
Ferrous	20%	80%	10%	10%
Non-ferrous	20%	80%	12.5%	7.5%
HDPE	5%	90%	10%	
PET	7%	50%	50%	
Other Plastics	5%	50%	10%	40%
Food	1%	90%	10%	
Yard	1%	90%	10%	
Wood	50%	50%	10%	40%
Other	10%			
C&D				
— Brick	30%	70%	30%	
— OCC	60%	60%	40%	
— Concrete	30%	85%	15%	
— Drywall	30%	70%	30%	
— Steel	60%	85%	15%	
— Wood	60%	80%	20%	
— Other	5%	80%	20%	

Notes:

1. All of the above estimates are based on limited available information, described in Section 6.4.1, but are considered to provide a reasonable preliminary estimate of the potential diversion impacts of the proposed 3Rs regulations and NAPP for the existing/committed IC&I system
2. Allocation refers to percentage of currently recycled material

- Manufacturing
  All OCC, ONP, glass, ferrous metal, non-ferrous metal, HDPE and PET generated by the manufacturing sector are potentially subject to the regulations. Since various types of plastics were grouped together in one category for presentation, not all plastics waste reported generated would be subject to the regulations. In the manufacturing sector, 50% of plastic waste materials generated were assumed to be plastics specified in the regulations (PET, HDPE, LDPE, polystyrene foam, trays, reels and spools). Accordingly, only 50% of the quantity of plastics waste generated in the manufacturing sector was considered in the estimation of potential diversion.

  80% of wood was assumed to be potentially recyclable and subject to the regulations within the manufacturing sector.

  20% of mixed paper waste generation was assumed to be fine paper, except for tobacco industry for which 50% of mixed paper waste was assumed, and for printing and publishing, for which 70.9% of total waste was assumed (Gore & Storrie, 1991). All of this material could potentially be subject to mandatory source separation.

- Transport/Communication/Utilities
  This sector includes truck, rail and shipping transport, as well as communications and utilities. Some activities have similar characteristics to the manufacturing sector, while others are office-related facilities. It was assumed that 50% of this sector is potentially subject to the regulations: 25% offices and 25% service/manufacturing-related operations. 60% of paper waste generated was assumed to be fine paper in office activities and 20% of paper waste generated was estimated to be fine paper in manufacturing-related activities. Also, in the manufacturing-related component, 50% of plastics and 80% of wood were assumed to be potentially subject to the regulations. Overall therefore, 50% of OCC, ONP, glass and metals, 25% of HDPE and PET, 20% of paper and wood and 12.5% of plastics were assumed to be potentially subject to mandatory source separation.

- The wholesale sector is not subject to the regulations.

- Retail
  All OCC, ONP, glass and metals were assumed to be potentially subject to mandatory source separation. The following fine paper fractions were assumed for the different sectors: SIC 60 - 3% total waste, SIC 61 - 3.9%, SIC 62 - 5.2%, SIC 63 -5.3%, SIC 65 - 5% (Gore &

Storrie, 1991). For SIC 64 and 69, the average fine paper fraction of the above SICs was assumed.

- **Financial/Insurance/Real Estate**
  All activity in this sector was considered to be office activity. Therefore, all OCC, ONP, glass and metals were assumed to be potentially subject to the regulations. For all groups, a fine paper content of the total mixed paper waste of 84% was assumed, based on extending the assumption that 53% of the total waste generation within SIC 70 (commercial banks) is fine paper (Gore & Storrie, 1991).

- **Non-Commercial (education and health/social)**
  This sector includes schools and hospitals, both of which are included in the regulations. Therefore, all of OCC, ONP, glass and metals were assumed to be potentially subject to mandatory source separation. It was assumed that for the education sector, 50% of the mixed paper is fine paper, and for the health/social service sectors, 20% of the mixed paper is fine paper.

- **Commercial**
  The commercial services sector is made up of a variety of activities, mostly categorized as offices or restaurants. All of these were considered potentially subject to the regulations. Therefore, all OCC, ONP, glass, and metals were assumed to be potentially subject to mandatory source separation. PET for the food/beverage and accommodation groups also was assumed to be potentially subject to source separation. The fine paper component of the waste stream for the different SICs was assumed to be as follows: for SIC 77, business services, like banks, 84% of mixed paper is fine paper; for SIC 91 - 2.7%, SIC 92 - 1%, SIC 96 - 2% of total waste generated is fine paper (Gore & Storrie, 1991). For SICs 97,98 and 99, the average fine paper fraction of the above groups was assumed. All of this material was assumed to be potentially subject to the regulations.

- **Public Administration**
  This sector involves primarily government administration services which for the most part, were assumed to be office activities. Therefore, all OCC, ONP, glass and metals were assumed to be potentially subject to the regulations. 70% of the mixed paper waste generated was assumed to be fine paper and therefore also potentially subject to mandatory source separation.

- **Construction and Demolition**
  C&D waste was estimated to account for approximately 21% of the IC&I waste stream in GTA in 1987. This estimate was based on estimates of C&D waste as a fraction of total waste for each region (Metro Works Dept., 1990, Morgan-Fraser, 1993, MacLaren Engineers, 1989). Table 5.7 in Chapter 5 presents the basis of the estimated proportion of each Region's waste which is C&D. This is estimated as follows: 13.2% in Durham, 10.3% in Metro Toronto, and 17.9% in York, in 1990, and 16.8% in Peel in 1987 (a similar fraction was assumed for Halton). In the absence of other data, it was assumed that 50% of C&D waste was construction waste and 50% of C&D waste was demolition waste. C&D waste composition data were taken from SWEAP Discussion Paper No. 4.3 (Proctor & Redfern et al., 1991) and were used to estimate the quantities of material potentially subject to the 3Rs regulations. These composition data are presented in Table 5.9, in Chapter 5.

- The packaging audits required under the 3Rs regulations would apply to major generators in SIC 10, 11, 27 and 37 and importers of food, beverage, paper and chemical products with sales greater than $20 million/year. However, NAPP applies to most significant packaging generators. It was assumed that for the materials used in packaging, 50% of the waste generated in the wholesale sector potentially would be diverted over time under the NAPP initiative (NAPP specifically is directed toward "brand owners", defined as manufacturers, distributors or importers of products and therefore includes the wholesale sector). Also it was assumed that 75% of remaining mixed paper waste from the manufacturing sector would be potentially diverted over time as a result of packaging and waste audits.

- It was assumed that 50% of PET and HDPE from all sectors potentially could be diverted over time as a result of waste audits as these materials command good market prices when clean, and there appears to be a demand (over the longer term). The HDPE market currently is soft, but is assumed to improve in the future.

- Finally, it was assumed that 20% of "other" waste material could be diverted over time. "Other" material refers to undefined waste in the composition analysis. It includes textiles, durable goods, non-specific industrial wastes and other materials not specified in the list of materials presented in this analysis. Also, some materials that have been specified in this analysis such as OCC, etc. are likely included.

6.4.3 Material-specific Assumptions on which Existing/Committed IC&I System Diversion Estimates Based

Assumptions made in the analysis are discussed according to material type below. For each waste material potentially affected by the 3Rs regulations and other initiatives such as NAPP, an estimate of the current recycling in the sectors affected by these initiatives must be developed in order to back this out of the estimates of total impact to identify the incremental effect. The wholesale sector is not subject to the currently-proposed 3Rs regulations, but it likely is significantly affected by NAPP and packaging audits. Therefore, estimates of current recycling activity for each material generated within the wholesale sector have been developed, and were assumed to continue on a voluntary basis. The assumptions used for these estimates are discussed by material type below. A summary of the assumed material allocation to generators subject and not subject to the regulations is presented in Table 6.6.

- **OCC**: For preliminary estimates it was assumed that 80% of all OCC currently being recycled, is recycled by the largest generators, while 20% of all OCC currently being recycled, is recycled by smaller generators not subject to the 3Rs regulations. A US study by AIA in 1993, indicated that 70% of OCC recycled in the commercial and retail sectors, the largest users of OCC, is recycled by the largest generators (AIA, 1993).

  The wholesale sector, which is not subject to the regulations was assumed to generate a significant portion of the OCC waste generated (25% or 88,600 tonnes). Since the wholesale sector is not subject to the regulations, current recycling within the wholesale sector had to be subtracted from the 80% assumed to be recycled by the largest generators. As an initial estimate it was assumed that approximately 40% (34,100 tonnes) of the OCC generated within the wholesale sector is currently being diverted. This represents 16% of the total OCC quantities currently being diverted by all sectors. Therefore, the portion attributed to establishments designated as major generators and subject to the regulations was assumed to be 64%. The estimate of 16% recycling by the wholesale sector may be revised upward in future refinements, if additional information becomes available.

- **ONP, fine paper, mixed paper, glass, ferrous and non-ferrous metals**: For a preliminary estimate, it was assumed that designated major generators account for 80% of the current recycling of these IC&I waste material categories. Since the wholesale sector is not subject to the regulations, current recycling within the wholesale sector had to be subtracted from the 80% assumed to be recycled by the largest generators.

The wholesale sector was assumed to account for 5% or 4,100 tonnes of the mixed paper (excluding ONP, OCC and fine paper) waste assumed to be currently recycled. This represents just over 1% of the combined mixed paper and OCC wastes assumed to be recycled, and roughly 11% of the mixed paper estimated to be generated within the wholesale sector. This is roughly in accordance with the NAPP survey which noted that 96% of paper packaging sent for recycling is OCC from all industry sectors (NAPP, 1990 survey).

Glass: The wholesale sector was assumed to account for 3.5% or 478 tonnes of the glass assumed to be currently recycled. This represents approximately 18% of glass estimated to be generated within the wholesale sector, which is roughly in accordance (slightly lower) with the level of glass container recycling suggested by NAPP (NAPP, 1988 and 1990 surveys).

Ferrous Metals: The wholesale sector is assumed to account for 3% or 1150 tonnes of the ferrous metal assumed to be currently recycled. This represents approximately 10% of ferrous metal estimated to be generated within the wholesale sector. This may be revised upward in future refinements of this analysis.

Non-ferrous Metals: The wholesale sector is assumed to account for 7.5% or 1,700 tonnes of the non-ferrous metal assumed to be currently recycled. This represents approximately 25% of non-ferrous metal estimated to be generated within the wholesale sector, which is similar to the level of recycling suggested by NAPP for non-ferrous metal packaging (NAPP, 1990 survey).

- HDPE: For preliminary estimates, 90% or 1,300 tonnes of the HDPE assumed to be recycled was attributed to establishments that may be covered by the 3Rs regulations. This represents over 50% of the HDPE waste generated by the manufacturing sector and therefore may be high. While much of the recycling may be attributed to the manufacturing industry, most HDPE is generated in the commercial and retail sectors and is not directly subject to mandatory source separation in most cases. However, recycling of HDPE in these sectors may be affected by packaging audits. The recycling of HDPE likely would be distributed more evenly among the manufacturing, commercial and retail sectors in future analyses.

- PET: For preliminary estimates, 50% or 174 tonnes of PET currently assumed to be recycled was attributed to designated major generators. Designated major generators include the food, beverage and accommodation services sectors which account for most of the

PET generated. This may be low and may be revised in later refinements to the estimates of coverage of the regulations. At this time, there is no reliable estimate of the number of these establishments which will be subject to the regulations.

- **Other Plastics**: A major portion of the other plastics waste generated occurs within the wholesale sector. As a preliminary estimate, 40% or 4,300 tonnes of the other plastics waste assumed to be currently recycled by all sectors was attributed to the wholesale sector. This represents approximately 8% of this material generated within the wholesale sector, which is roughly the level of recycling of plastics suggested by NAPP surveys.

  The manufacturing sector, which is required to source separate other plastics, is estimated to generate the largest quantity of other plastics wastes. Therefore, another 50% or 5,350 tonnes of the other plastics assumed to be currently recycled was attributed to establishments subject to the 3Rs regulations.

- **Wood**: The manufacturing sector is the largest generator of wood waste, followed by the wholesale sector. The wholesale sector was assumed to currently recycle significant quantities of wood, particularly pallets. As a preliminary estimate, the wholesale sector was assumed to account for 40% or 45,400 tonnes of the wood assumed to be currently recycled. This represents approximately 60% of the wood generated within the wholesale sector. NAPP suggested a 40% recycling rate in Ontario (NAPP, 1990 survey) for this material and it was assumed to have increased over time with the longer affect of landfill bans on wood.

  Also, 50% of the wood assumed to be currently recycled is attributed to designated major generators.

- **C&D**: There is little reliable information for allocating the current diversion activity within the various C&D projects. As a preliminary estimate, it was assumed that the larger projects generally account for the most significant proportion of current diversion. Since source separation requires a certain amount of space, it may be assumed that larger projects achieve greater diversion rates due to greater available space. OCC is readily separated and therefore is assumed to be recovered to a greater extent by small projects. Table 6.6 shows the assumed allocation of recycling activity for C&D waste materials.

6.4.4 Range of Diversion Estimates for Existing/Committed IC&I System

As described in Section 6.4.1, factors of 20%, 40% and 60% were applied to represent different coverage levels of the proposed 3Rs regulations. The potential effect of the mandatory source separation defined in the 3Rs regulations on diversion of various materials if all establishments were to participate is shown in Column 3 of Tables 6.3, 6.4 and 6.5, representing the three different assumed levels of coverage. The estimated net diversion impact (above existing diversion) of the 3Rs regulations on IC&I waste diversion is shown in column 4 of Tables 6.3, 6.4 and 6.5. In order to determine the net diversion impact of the 3Rs Regulations on diversion, the current voluntary recycling activity of establishments designated as major generators had to be subtracted from the estimates of potential diversion due to the proposed regulations.

For some materials the net impact of the regulations is zero, depending on the number of establishments subject to the 3Rs regulations: that is, all of the subject material generated by major generators is assumed to be currently recycled (e.g. OCC at 20% and 40% "coverage" levels - column 4 Tables 6.4 and 6.5).

The potential effect of NAPP, other packaging audits and other potential diversion initiatives were included in this analysis. Column 5 of Tables 6.3, 6.4 and 6.5 shows the estimated potential diversion of various materials as a result of NAPP, packaging audits and other potential recycling efforts, as described in Section 6.2, if all establishments were to participate.

There are currently no reliable estimates of the number of establishments in GTA which participate voluntarily in packaging reduction under NAPP. Therefore, a preliminary sensitivity analysis was conducted in the same way as for the analysis of the effect of the waste related requirements of the 3Rs regulations: factors of 20%, 40% and 60% were applied to the estimated potential diversion under NAPP. Also, an estimate of potential diversion of mixed paper packaging in the manufacturing sector due to packaging audits was treated in the same way, by applying factors of 20%, 40% and 60% to the estimates of the total material potentially covered by the regulations.

Current diversion levels of materials affected by these initiatives was also considered. The quantity of each material assumed to be currently diverted in the wholesale sector (calculated as a percentage of the total quantity assumed to have been diverted by all sectors) is shown in Table 6.6. These estimates of current recycling activity were subtracted from the estimated potential diversion due to NAPP and packaging audits. The estimated additional diversion achieved as a result of these initiatives is shown in Column 6 of Tables 6.3, 6.4 and 6.5.

Estimated overall diversion under the Existing/Committed System is shown in column 7 of Tables 6.3, 6.4 and 6.5, representing different levels of coverage of the 3Rs regulations and packaging audits. The amount of materials estimated to required disposal in each case is shown in Column 9 of these tables. All calculations were carried out using 1992 composition estimates for illustrative purposes.

In summary, it appears that between 34% and 46% of IC&I waste could potentially be diverted under the Existing/Committed system.

6.5 Estimates of Waste Diversion by the IC&I Extended 3Rs Regulations System

Under System 3, extended 3Rs regulations would be designed to target 90% of the waste generated by all IC&I establishments. The following materials would be included in the extended 3Rs regulations:

- OCC
- ONP
- fine paper
- glass
- ferrous metal, and
- non-ferrous metal.

Mandatory source separation of a longer list of materials, currently only directed to the manufacturing sector, would be extended in System 3 to apply to the retail and wholesale sectors as well. In addition to the above materials, the manufacturing, wholesale and retail sectors would therefore also be required to source separate the following materials:

- plastics - PET, HDPE, LDPE (polystyrene film, spools etc.), and
- wood.

90% of the following C&D waste materials would be targetted:

- brick
- OCC
- concrete
- drywall, steel and
- wood.

It was assumed for diversion estimates that it would be unlikely that 90% of any waste material could be recovered because of contamination,

identification problems, handling difficulties, other reasons for rejection and non-compliance with the regulations. Thus, for this analysis it was assumed that 85% of targetted materials might be recoverable.

Table 6.7 presents diversion estimates for the Extended 3Rs Regulations System. As with Systems 1 and 2, an estimate of potential diversion was developed for each material. The quantity of a material generated by all sectors which are subject to the Extended 3Rs Regulations was multiplied by 85%. This estimated potential diversion is shown in column 3 of Table 6.7.

Since in some cases different materials were grouped together in one category for presentation (e.g. various types of plastics), not all of a certain material category generated would be subject to the Extended 3Rs Regulations. In these cases a factor has been applied to the total quantity of such a material category generated by a sector to account for diversion of only the relevant material. In the manufacturing sector, 50% of plastics waste materials generated were assumed to be plastics specified in the regulations (LDPE, polystyrene foam, trays, reels and spools). Accordingly, only 50% of the quantity of plastics waste generated in the manufacturing sector was considered in the estimation of potential diversion. A factor of 85% is applied to account for wastes not recoverable.

According to a survey in Resource Recycling (Nov. 91), LDPE film and polystyrene constitute a greater fraction of the plastics waste generation by non-manufacturing sectors. Thus, it was assumed that a greater portion of the plastics generation within most sectors would be subject to the Extended 3Rs Regulations. As a preliminary estimate, this was estimated to be 75% of plastics in the wholesale and retail sectors. A factor of 85% is applied to account for wastes not recoverable.

It was assumed that 80% of wood waste in manufacturing, retail and wholesale sectors is recyclable. Therefore, 80% of the wood waste generated in these sectors was considered in estimating potential diversion. A factor of 85% is applied to account for wastes not recoverable.

Additional diversion of mixed paper, PET and HDPE would be possible under NAPP and packaging audits, etc. (The other material wastes covered by NAPP would now be targetted in the Extended 3Rs Regulations). The portion of the PET and HDPE already estimated to be diverted due to the 3Rs regulations was subtracted from the estimated potential diversion under NAPP. A participation factor of 20% (as with the first case considered for System 2) was assumed for estimating potential mixed paper diversion for this analysis. Estimated additional diversion of these materials is shown in column 4 of Table 6.7.

Table 6.7
Estimate of Diversion of IC&I Waste Under Extended 3Rs System Greater Toronto Area

Waste Component	Estimated IC&I Waste Generation (tonnes)	Estimated IC&I Diversion Existing - 3R (tonnes) (column 2)	Estimated IC&I Diversion 90% Cut-off (tonnes) (column 3)	Estimated IC&I Diversion Additional Mtls, NAPP, Audits (tonnes) (column 4)	Estimated IC&I Total Diversion (tonnes) (column 5)	Estimated IC&I Diversion Rate (%)	Estimated IC&I Waste Disposed (by difference) (tonnes)	Estimated Composition of Disposed IC&I Waste (%)
Total IC&I Waste (tonnes)	2,885,315							
Paper								
Newspaper	87,620	13,143	74,477	0	74,477	85%	13,143	1%
Corrugated cardboard (OCC)	356,681	214,009	303,179	0	303,179	85%	53,502	4%
Fine Paper		165,304	177,977	0	177,977			
Mixed paper (1)	551,014	82,652	0	3,206	85,858	48%	287,178	22%
Subtotal (Paper)	995,315	475,108	555,634	3,206	641,492	64%	353,823	27%
Glass	75,798	13,644	64,429	0	64,429	85%	11,370	1%
Ferrous	191,733	38,347	162,973	0	162,973	85%	28,760	2%
Non-ferrous	116,171	23,234	98,745	0	98,745	85%	17,426	1%
Subtotal (Metal)	307,904	61,581	261,719	0	261,719	85%	46,186	4%
Plastic								
PET	4,966	348	584	1,402	1,985	40%	2,980	0%
HDPE	29,617	1,481	13,539	7,877	21,416	72%	8,201	1%
Other Plastic	213,888	10,694	75,492	0	75,492	35%	138,396	11%
Subtotal (Plastic)	248,471	12,523	89,615	9,279	98,893	40%	149,577	11%
Organics								
Food wastes	194,262	1,943	0	0	1,943	1%	192,319	15%
Yard waste	26,923	269	0	0	269	1%	26,653	2%
Subtotal (Organics)	221,184	2,212	0	0	2,212	1%	218,972	17%
Wood Waste	227,158	113,579	144,119	0	144,119	63%	83,039	6%
Construction/Demolition Waste								
Brick,OCC,Conc,Drywl,Steel,Wood	366,133	200,840	311,213	0	311,213	85%	54,920	4%
Other	243,581	12,179	0	0	12,179	5%	231,402	18%
Subtotal (Organics)	609,714	213,019	311,213	0	323,392	53%	286,322	22%
Other	199,770	19,977	0	19,973	39,950	20%	159,820	12%
TOTAL	2,885,315	911,642	1,426,727	32,457	1,576,205	55%	1,309,110	100%

Notes:
1. Includes some fine paper of some sectors
2. All diversion estimates illustrated using assumed 1992 data.

Assumed existing diversion levels are shown in column 2 of Table 6.7. Estimated total diversion under System 3 is shown in column 5. It was estimated that approximately 55% of IC&I waste material could be diverted under System 3.

6.6 Estimates of Waste Diversion by the IC&I Expanded 3Rs Regulations System

The Expanded 3Rs Regulations System (System 4) builds on System 3 (Extended 3Rs Regulations) and requires source separation and diversion of a larger number of dry materials by all sectors. A similar method to that used for analysis of System 3 was used to estimate the potential diversion of this system.

Mandatory separation of all HDPE, PET plastics and wood is extended to all sectors in this system. Since different plastics were grouped together in one category for presentation, not all of plastic wastes generated would be subject to the Expanded 3Rs Regulations. In the manufacturing sector, 50% of plastics waste materials generated were assumed to be plastics specified in the proposed 3Rs regulations in the Existing/Committed system (LDPE, polystyrene foam, trays, reels and spools). Accordingly, only 50% of the quantity of plastics waste generated in the manufacturing sector was considered in the estimation of potential diversion.

According to a survey in Resource Recycling (Nov. 91), LDPE film and polystyrene constitute a greater fraction of the plastics waste generation by non-manufacturing sectors. Thus, it was assumed that a greater portion of the plastics generation within most sectors would be subject to the Expanded 3Rs Regulations. Therefore, estimates of diversion of these materials in the remaining sectors which were not required to source separate these materials under System 3 (the primary, TCU, FIRE, commercial, non-commercial and public administration sectors), in addition to the wholesale and retail sectors, were calculated by applying a factor of 75% to the quantity of plastics generated in each sector. A factor of 85% is applied to account for wastes not recoverable.

It was assumed that 80% of wood waste in all sectors is recyclable. Therefore, 80% of the wood waste generated in all sectors was considered in estimating potential diversion. A factor of 85% is applied to account for wastes not recoverable.

In the Expanded 3Rs Regulations System, mixed paper (in addition to fine paper) from all sectors was targetted and would be subject to mandatory source separation. It would likely be collected as a mixed paper stream and

after processing, a portion of it would be marketed as lower grade fibre. Potential diversion of mixed paper was calculated in the same way as for most other materials by multiplying the quantity generated by 85% to account for quantities not recoverable.

Table 6.8 presents diversion estimates for the Expanded 3Rs Regulations System. The additional diversion obtained under System 4 is shown in column 4 of Table 6.8. Total diversion is shown in column 5. The estimated overall diversion achievable by the Expanded 3Rs Regulations System was estimated to be approximately 64% of the IC&I waste stream.

6.7 Estimates of Waste Diversion by the IC&I Expanded 3Rs Regulations with Organics System

In the Expanded 3Rs Regulations with Organics System wet organics (food and yard waste), which constitute an estimated 7.7% of IC&I sector wastes, were included in the list of materials targetted for source separation. Sectors targetted for mandatory separation requirements would be those that contribute to 90% of all wet organic waste generated. This system builds on Systems 3 and 4 and a similar method was used to estimate the potential diversion.

Food waste processors, food terminals, grocery stores, restaurants, hotels, hospitals and schools are the largest generators of food waste in the IC&I sector. Since they are the most significant food waste generators, and since it was assumed that they would most easily be able to institute source separation of food wastes, these sectors would likely be targetted specifically - that is, SIC 10 and 11 in the manufacturing sector, SIC 60 and 65 in the retail sector, SIC 85 and 86 in the non-commercial services sector, and SIC 91, 92 and 96 in the commercial service sector. In all, these represent 72% of food waste generation. Therefore, in order to achieve 90% diversion of food and yard wastes, additional sectors would be targetted.

For the purposes of estimating quantities potentially diverted under this system, as for other materials, a factor of 85% was applied to the total food and yard waste generated.

The estimated diversion under System 5 is summarized in Table 6.9. The additional quantities of wet organics diverted are shown in column 4. Column 5 shows total diversion for all materials. Overall diversion potentially achievable by the Expanded 3Rs Regulations with Organics was estimated to be approximately 70% of the IC&I waste generated.

Table 6.8
Estimate of Diversion of IC&I Waste
Under Expanded 3Rs System
Greater Toronto Area

Waste Component	Estimated IC&I Waste Generation (tonnes)	Estimated IC&I Diversion Existing - 3R (tonnes) (column 2)	Estimated IC&I Diversion System 3 (tonnes) (column 3)	Estimated IC&I Diversion Additional Materials (tonnes) (column 4)	Estimated IC&I Total Diversion (tonnes) (column 5)	Estimated IC&I Diversion Rate (%)	Estimated IC&I Waste Disposed (by difference) (tonnes)	Estimated Composition of Disposed IC&I Waste (%)
Total IC&I Waste (tonnes)	2,885,315							
Paper								
Newspaper	87,620	13,143	74,477	0	74,477	85%	13,143	1%
Corrugated cardboard (OCC)	356,681	214,009	303,179	0	303,179	85%	53,502	5%
Fine Paper		165,304	177,977	0	177,977			
Mixed paper (1)	551,014	82,652	85,858	204,526	290,384	85%	82,652	8%
Subtotal (Paper)	995,315	475,108	641,492	204,526	846,018	85%	149,297	14%
Glass	75,798	13,644	64,429	0	64,429	85%	11,370	1%
Ferrous	191,733	38,347	162,973	0	162,973	85%	28,760	3%
Non-ferrous	116,171	23,234	98,745	0	98,745	85%	17,426	2%
Subtotal (Metal)	307,904	61,581	261,719	0	261,719	85%	46,186	4%
Plastic								
PET	4,966	348	1,985	2,236	4,221	85%	745	0%
HDPE	29,617	1,481	21,416	3,759	25,175	85%	4,443	0%
Other Plastic	213,888	10,694	75,492	44,240	119,732	56%	94,155	9%
Subtotal (Plastic)	248,471	12,523	98,893	50,234	149,128	60%	99,343	10%
Organics								
Food wastes	194,262	1,943	1,943	0	1,943	1%	192,319	18%
Yard waste	26,923	269	269	0	269	1%	26,653	3%
Subtotal (Organics)	221,184	2,212	2,212	0	2,212	1%	218,972	21%
Wood Waste	227,158	113,579	144,119	10,349	154,467	68%	72,690	7%
Construction/Demolition Waste								
Brick,OCC,Conc,Drywl,Steel,Wood	366,133	200,840	311,213	0	311,213	85%	54,920	5%
Other	243,581	12,179	12,179	0	12,179	5%	231,402	22%
Subtotal (Organics)	609,714	213,019	323,392	0	323,392	53%	286,322	27%
Other	199,770	19,977	39,950	0	39,950	20%	159,820	15%
TOTAL	2,885,315	911,642	1,576,205	265,109	1,841,314	64%	1,044,001	100%

Notes:
1. Includes some fine paper of some sectors
2. All diversion estimates illustrated using assumed 1992 data.

Table 6.9
Estimate of Diversion of IC&I Waste
Under Expanded 3Rs with Organics System
Greater Toronto Area

Waste Component	Estimated IC&I Waste Generation (tonnes)	Estimated IC&I Diversion Existing - 3R (tonnes) (column 2)	Estimated IC&I Diversion System 3 (tonnes) (column 3)	Estimated IC&I Diversion Addition of Organics (tonnes) (column 4)	Estimated IC&I Total Diversion (tonnes) (column 5)	Estimated IC&I Diversion Rate (%)	Estimated IC&I Waste Disposed (by difference) (tonnes)	Estimated Composition of Disposed IC&I Waste (%)
Total IC&I Waste (tonnes)	2,885,315							
Paper								
Newspaper	87,620	13,143	74,477	0	74,477	85%	13,143	2%
Corrugated cardboard (OCC)	356,681	214,009	303,179	0	303,179	85%	53,502	6%
Fine Paper		165,304	177,977	0	177,977			
Mixed paper (1)	551,014	82,652	85,858	204,526	290,384	85%	82,652	10%
Subtotal (Paper)	995,315	475,108	641,492	204,526	846,018	85%	149,297	17%
Glass	75,798	13,644	64,429	0	64,429	85%	11,370	1%
Ferrous	191,733	38,347	162,973	0	162,973	85%	28,760	3%
Non-ferrous	116,171	23,234	98,745	0	98,745	85%	17,426	2%
Subtotal (Metal)	307,904	61,581	261,719	0	261,719	85%	46,186	5%
Plastic								
PET	4,966	348	1,985	2,236	4,221	85%	745	0%
HDPE	29,617	1,481	21,416	3,759	25,175	85%	4,443	1%
Other Plastic	213,888	10,694	75,492	44,240	119,732	56%	94,155	11%
Subtotal (Plastic)	248,471	12,523	98,893	50,234	149,128	60%	99,343	12%
Organics								
Food wastes	194,262	1,943	1,943	163,180	165,123	85%	29,139	3%
Yard waste	26,923	269	269	22,615	22,884	85%	4,038	0%
Subtotal (Organics)	221,184	2,212	2,212	185,795	188,007	85%	33,178	4%
Wood Waste	227,158	113,579	144,119	10,349	154,467	68%	72,690	8%
Construction/Demolition Waste								
Brick,OCC,Conc,Drywl,Steel,Wood	366,133	200,840	311,213	0	311,213	85%	54,920	6%
Other	243,581	12,179	12,179	0	12,179	5%	231,402	27%
Subtotal (Organics)	609,714	213,019	323,392	0	323,392	53%	286,322	33%
Other	199,770	19,977	39,950	0	39,950	20%	159,820	19%
TOTAL	**2,885,315**	**911,642**	**1,576,205**	**450,904**	**2,027,109**	**70%**	**858,206**	**100%**

Notes:
1. Includes some fine paper of some sectors
2. All diversion estimates illustrated using assumed 1992 data.

6.8 Estimates of Waste Diversion by the No Unprocessed IC&I Waste to Landfill System

This system builds on System 2, Existing/Committed. As presented in the description of this System in Section 6.2, it has been assumed that the requirements of this System would be met in a number of ways. These would include greater source separation of some materials, and processing of mixed waste streams (likely from smaller generators) in a mixed waste processing facility. This assumption was based on current practice in GTA as well as experience in other jurisdictions (e.g. Minneapolis/St.Paul) (Rafferty, 1993).

For the purposes of this analysis, it was assumed that the waste mandated for source separation in the Existing/Committed System would continue to be source separated and diverted from landfill. The 20% coverage case has been used for illustrative purposes. The estimates of the potential diversion achievable by the Existing/Committed System are summarized in Section 6.4 and shown in Table 6.3 for the 20% coverage case.

It was assumed that all of the waste materials estimated to be disposed in the Existing/Committed System would be processed to recover recyclable/reusable materials prior to being disposed in landfills. Also, it was assumed that all of this material would be handled as mixed waste streams. This represents 66% of the total IC&I waste stream for the 20% coverage case. Therefore, building on the 20% coverage case for System 2, the material assumed to undergo some further processing is shown in column 3 of Table 6.10.

It was also assumed that under such a system, while more of the IC&I waste potentially would be handled, there would be a portion of the waste for which it would be unviable to recover material for diversion due to contamination, deterioration, limited reprocessing technology, etc. To account for this, recovery factors were applied to all of the material assumed to be available and collected for processing.

Therefore, for this analysis the following recovery factors were applied to the quantities of waste assumed to be collected as mixed wastes for processing and recovery:

- plastics 75%
- organics 75%
- "other" C&D wastes 80%
- wood 80%
- "other" wastes 25%
- all other materials 90%

Table 6.10
Estimate of Diversion Under
No Unprocessed Waste To Landfill System
Greater Toronto Area

Waste Component	Estimated IC&I Waste Generated (tonnes)	Estimated IC&I Diversion Existing 3R (tonnes (column 2)	Estimated IC&I Waste Disposed Exist/Comm (tonnes) (column 3)	Estimated IC&I Waste Recovered from Processing (tonnes) (column 4)	Estimated IC&I Waste Recovered for Composting (tonnes) (column 5)	Estimated IC&I Total Diversion (tonnes) (column 6)	Estimated IC&I Diversion Rate (%)	Estimated IC&I Waste Disposed (by difference) (tonnes)	Estimated Composition of Disposed IC&I Waste (%)
Total IC&I Waste (tonnes)	2,885,315								
Paper									
Newspaper	87,620	18,694	68,926	62,033	0	80,727	92%	6,893	1%
Corrugated cardboard (OCC)	356,681	214,009	142,673	128,405	0	342,414	96%	14,267	2%
Fine Paper		165,304		0	0	165,304	0%	0	
Mixed paper	551,014	85,858	299,852	269,866	0	355,725	95%	29,985	5%
Subtotal (Paper)	995,315	483,865	511,450	460,305	0	944,170	95%	51,145	8%
Glass	75,798	16,896	58,902	53,012	0	69,908	92%	5,890	1%
Ferrous	191,733	40,965	150,768	135,692	0	176,657	92%	15,077	2%
Non-ferrous	116,171	24,499	91,672	82,505	0	107,004	92%	9,167	1%
Subtotal (Metal)	307,904	65,464	242,441	218,197	0	283,660	92%	24,244	4%
Plastic									
PET	4,966	1,995	2,971	2,674	0	4,669	94%	297	0%
HDPE	29,617	14,868	14,749	13,274	0	28,142	95%	1,475	0%
Other Plastic	213,888	14,763	199,125	149,344	0	164,107	77%	49,781	8%
Subtotal (Plastic)	248,471	31,625	216,845	165,292	0	196,918	79%	51,553	8%
Organics									
Food wastes	194,262	1,943	192,319	0	144,239	146,182	75%	48,080	8%
Yard waste	26,923	269	26,653	0	19,990	20,259	75%	6,663	1%
Subtotal (Organics)	221,184	2,212	218,972	0	164,229	166,441	75%	54,743	9%
Wood Waste	227,158	113,579	113,579	90,863	0	204,442	90%	22,716	4%
Construction/Demolition Waste									
Brick,OCC,Conc,Drywl,Steel,Wood	366,133	200,840	165,293	132,234	0	333,074	91%	33,059	5%
Other	243,581	12,179	231,402	17,355	0	29,534	12%	214,047	35%
Subtotal (Organics)	609,714	213,019	396,695	149,589	0	362,609	59%	247,105	40%
Other	199,770	39,950	159,820	4	0	39,954	20%	159,816	26%
TOTAL	2,885,315	966,610	1,918,705	1,137,262	164,229	2,268,102	79%	617,213	100%

Notes:

1. Includes some fine paper of some sectors
2. All diversion estimates illustrated using assumed 1992 data.

These recovery factors are considered optimistic and may be revised in future analyses.

The estimated diversion potentially achieved by System 6 is summarized in Table 6.10. Columns 4 and 5 show diversion potentially achieved on top of the Existing/Committed system. Column 6 shows total diversion estimated to be potentially achieved for all materials. This was estimated to be up to approximately 79% of the IC&I waste stream.

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7.0 GTA 3Rs ANALYSIS - ASSESSMENT AND EVALUATION OF THE 3Rs SYSTEM

7.1 Overview

This section of the report details the net effects analysis process undertaken by the Service discipline. The six residential and six IC&I systems were measured, and compared according to a set of established criteria. The relative importance of these criteria was evaluated, weighted and applied to key elements of each system in order to arrive at a hierarchy of highest to lowest ranked 3Rs systems in terms of the service component.

7.2 Net Effects Analysis

7.2.1 Methodology Description

A six step process was conducted to complete the Net Effects Analysis of GTA Residential Systems for the Service discipline. This included:

1. Completion of set of Generic Net Effects Tables for the Regions of Durham, Peel, Metro Toronto and York, for each of six residential systems.

2. Completion of Generic Net Effects tables for the entire GTA as one unit, for six IC&I systems.

3. Completion of a Net Effects Analysis, for each Criteria Group, for each region, for each of six residential IC&I systems.

4. Completion of a Net Effects Analysis for each Criteria Group for each of six IC&I systems for the GTA.

5. Criteria were ranked, according to utility to the analysis, level of importance of the criteria relative to others, as well as the magnitude, duration, significance and certainty of effects.

6. A comparative evaluation of each Residential system, based on the Net Effects Analysis of the service criteria was completed, for each region for residential systems and for the GTA as a whole for IC&I systems.

Generic Net Effects Tables and region-specific Net Effects Tables for Residential and IC&I systems are presented in Schedules "P" and "Q" of this report.

7.2.2 Service Criteria

The "Service" Criteria Group contains four criteria which were applied to the components of each system in assessing their impacts from the perspective of Service. Generic and region-specific Net Effects Tables were created in order to complete this analysis. The criteria used in the tables include:

- **Reliability**
  The reliability of each system was assessed according to whether the technologies which form the system had been proven reliable. Reliable was defined as a program that had operated successfully in at least one jurisdiction in the world, at full scale, for a period of at least one year (with no plant shut-downs due to operational problems). The issue of whether the system is dependent on the success of a single approach was also considered. Single approach systems are more susceptible to collapse in the event of failure of any of the parts, and are therefore considered less reliable.

- **Flexibility**
  System flexibility was judged by the types and quantities of waste accommodated and compatibility with the existing system. This criterion incorporates the ability of the system to adapt to changing waste characteristics and quantities. Whether the system would help each GTA region to achieve Ontario targets for 50% waste diversion was also considered.

- **Performance**
  System performance was judged according to the quantity of material diverted or disposed and the potential for marketing materials diverted. A key factor in performance incorporates the issue of marketability of materials recovered. It was assumed for preliminary diversion estimates that markets would be available for all recovered materials, although this is not necessarily the case at this time. Markets are discussed in detail in Appendix "H" of this report, along with the limitations and problems for some materials.

- **Social Acceptability**
  The social acceptability of each system was evaluated on the basis of the potential effects of the systems on participation, attitudes and perception of the public of 3Rs activities as well as willingness to pay for the system.

7.2.3 Residential Criteria Ranking

To assist in ranking systems according to Criteria Group, the individual criteria were ranked. This ranking was completed on the basis of the level of importance of the criteria relative to the others. In order to rank the criteria, consideration was given to the magnitude of effects, duration of effects, significance of effects, certainty of effects and the relative difference among options.

Two categories of top importance were identified. "Performance" and "Reliability" are considered to be of greatest and equal importance within the service group. Performance measures the amount of waste diversion (tonnages diverted expressed as a percentage of waste generation).

Reliability measures whether systems are likely to work (due to technology and operational factors) and whether the system as a whole is vulnerable to breakdown. These two criteria are given the highest ranking since, taken together, they provide the strongest and most reliable indicators of whether any significant measure of waste diversion has been or is likely to be achieved, on a consistent, sustainable basis. These two criteria provide the best means of assessing the significance, certainty, and magnitude of effects, and highlight the difference among options.

The criterion "Social Acceptability" was ranked second in importance. This criterion measures whether the public is likely to reject or accept a system. It provides an indicator of whether residents will participate in source separation and other programs that are fundamental to ensuring diversion performance. This criterion is helpful in evaluating the certainty and duration of effects.

Flexibility was ranked lowest in importance since it is not very helpful in determining the magnitude of differences between the duration, certainty or significance of effects. This criterion evaluates systems according to the type and quantities of waste accepted and system compatibility with the existing or Existing/Committed system. The logic behind such a criterion is that systems which are proven to be incapable of expansion or that demand significant alteration of existing systems are likely to be faced with greater challenges in terms of ensuring public participation. However, some systems which are not compatible with the existing system have significant benefits in other areas, and should not be discounted due to lack of flexibility.

The criteria rankings for the Service Criteria Group are presented in Table 7.1.

7.2.4 Residential System Ranking Approach

By considering the systems ranking by criteria and criteria rankings, an overall ranking for each system was completed for the Service Criteria Group for each region. Systems were ranked from "lowest" to "highest". Any system that received a mix of lowest and highest for Reliability and Performance (the two top ranked criteria) were ruled out of contention as highest ranked systems. Any such systems were then evaluated by Social Acceptability and Flexibility.

A net effects summary of residential systems for service is presented for each region in tables at the end of this chapter. Information is presented as follows:

Table 7.3: Region of Durham
Table 7.4: Metropolitan Toronto
Table 7.5: Region of York
Table 7.6: Region of Peel

7.2.5 IC&I Criteria Ranking

Three criteria, "Performance," "Reliability" and "Social Acceptability" were considered to be of greatest and equal importance for the IC&I Service criteria. These criteria are given the highest ranking since, taken together, they provide the strongest and most reliable indication of whether any significant measure of waste diversion is likely to be achieved by the six IC&I systems considered. These criteria provide the best means of assessing the significance, certainty, and magnitude of effects, and highlight the difference among options.

"Performance" measures the amount of waste diversion (tonnes diverted expressed as a percentage of waste generation). This best assesses the significance and magnitude of waste diversion effects among the options. It has been assumed for the purpose of the evaluation that markets will be available for the materials diverted by these systems. "Reliability" measures whether systems are likely to work (due to technology and operational factors) and whether the system as a whole is vulnerable to break-down. Reliability is necessary to guarantee the diversion level estimated for the systems.

"Social Acceptability" measures whether institutions, mostly in the private sector, are likely to comply with system requirements that are fundamental to ensuring diversion, and therefore performance. This criterion is helpful in evaluating the certainty and duration of effects.

"Flexibility" was ranked lowest in importance of the four service criteria. This criterion evaluates the range of types and quantities of waste accepted by different systems, and whether these can be varied. The logic behind such a criterion is that systems which are proven to be incapable of expansion or

TABLE 7.1

GTA Residential Systems
SERVICE CRITERIA RANKING

Criterion	Rank Order	
Reliability	1	This criterion is ranked highest as the reliability of a waste diversion system is considered of major significance, and is a reliable measure for distinguishing between different systems. Also, the level of confidence with which diversion of a system can be estimated is an important factor in the final choice
Flexibility	3	Flexibility is ranked least important in the service group, as it is not an essential feature for a waste diversion system
Performance	1	Performance is considered the most important criterion within the service group, as it measures how effective a waste diversion system will be. If performance is not reasonable, then a diversion system should be eliminated from serious consideration
Social Acceptability	2	Social acceptably is ranked second in importance in the service grouping as it should not be considered a significant factor in the choice of a system. Many waste diversion systems become socially acceptable over time.

modification are likely to be faced with greater challenges in terms of ensuring service and diversion, if the quantity and composition of the waste stream varies. However, this criterion is not considered essential to provision of a successful IC&I waste diversion system as most of the materials generated can be managed by the existing system (which therefore is considered flexible).

The criteria rankings for the Service Criteria Group are presented in Table 7.2 along with the rationale for these rankings.

7.2.6 IC&I System Ranking Approach

Any system that received a mix of a lowest and highest ranked for Reliability, Performance and Social Acceptability (the top ranked criteria) were ruled out of contention as a highest ranked system.

7.3 Regional Comparative Evaluations

This section provides a detailed explanation of the evaluations presented in the above listed tables. For the purposes of Net Effects Assessment, the Residential Systems evaluated were identified as follows:

System Number	System Name
1	Residential Existing
2	Residential Existing/Committed
3	Direct Cost
4	Expanded Blue Box
5	Wet/Dry
6A	Mixed Waste Processing with Low Quality Finished Compost
6B	Mixed Waste Processing with High Quality Finished Compost

A net effects summary of IC&I systems (for service) in the GTA is presented as Table 7.7 which follows residential Tables (7.3 to 7.6) at the end of the chapter.

7.3.1 Residential Systems for Region of Durham

Table 7.3 presents a comparative evaluation of systems for the Region of Durham and summarizes system ranking by service criterion, and overall system ranking for service for Region of Durham.

TABLE 7.2

Greater Toronto Area IC&I Systems
SERVICE CRITERIA RANKING

DISCIPLINE		
Criterion	**Rank Order**	**Rationale**
Reliability	1	Reliability is ranked one of the most important criteria since reliability of a waste diversion system affects performance and participation. The major distinguishing feature among systems is the extent to which technologies used or required are proven.
Flexibility	2	Flexibility addresses the range and quantity of wastes processed, and compatibility with the existing system. Flexibility is ranked as the least important criterion in the service group as it is not an essential feature of the IC&I waste management system.
Performance	1	Performance is considered one of the most important criteria within the service group, as it measures how effective a waste diversion system will be. If performance is not sufficient, then a diversion system does not meet its basic objective.
Social Acceptability	1	Social acceptability is considered as one of the most important criteria in the service group for IC&I systems, as it attempts to measure the burden imposed on individual firms by the different systems, and the extent to which they will respond, and participate in more stringent regulatory or cost requirements. It assists in distinguishing between systems, as those which do not expect reasonable participation will be unable to achieve high diversion levels.

1. A ranking of "1" represents the criterion considered to be the most important.

TABLE 7.3

REGION OF DURHAM
NET EFFECTS SUMMARY FOR SERVICE

Goal/Criteria Group/Criteria	System 1 Existing	System 2 Existing/ Committed	System 3 Direct Cost	System 4 Expanded Blue Box	System 5 Wet/Dry	System 6A Mixed Waste Processing (unsuccessful)	System 6B Mixed Waste Processing (successful)
IMPACT:							
Service	Lowest	Lowest	Third highest	Highest	Second highest	Lowest	Lowest
Reliability	Highest due to: • technologies presently exist and are proven • success is not due to reliance on single approach	Highest due to: • technologies presently exist and are proven • success is not due to reliance on single approach	Second highest due to: • technologies presently exist and are proven (in North America) • success relies on single economic incentive based approach • success partially dependent on participation in additional source separation by residents	Second highest due to: • technologies presently exist and are proven • success is not due to reliance on a single approach • relies on increased public participation	Second lowest due to: • technology proven, but not in North America or Ontario • relies on increased public participation	Lowest due to: • unproven technology that is not fully successful anywhere in North America at present • applies single approach to third bag of waste • approach contradicts present policy of source separation	Lowest due to: • unproven technology that is not fully successful anywhere in North America at present • applies single approach to third bag of waste • approach contradicts present policy of source separation

Flexibility	Lowest due to: • limited range and quantity of materials accommodated	Lowest due to: • limited range and quantity of materials accommodated with no significant increase in demand expected • committed MRF to provide increased processing capacity	Lowest due to: • limited range of materials accommodated • basic compatibility with existing/ committed system • depends on homeowner for success	Third highest: • collects wider range and higher quantities of materials • requires switch to weekly collection of recyclables • compatible with and expands on existing/ committed system • depends on homeowner for success	Second highest • collection of wider range and greater quantities of materials (including wet waste and others not captured in residential blue box programs) • expanded or new MRF and new centralized compost plant required to accommodate increased quantities of materials • requires fundamental change to existing system for residential participation system	Highest • provides ability to divert both wet and dry wastes • increased waste diversion • compatible with existing collection system • may decrease value, selling price of secondary materials and efficiency of recycling due to contamination • compost quality unlikely to meet Ontario guidelines	Highest • provides ability to divert both wet and dry wastes • increased waste diversion • compatible with existing collection system • may decrease value, selling price of secondary materials and efficiency of recycling • compost quality unlikely to meet Ontario guidelines
Performance	Lowest due to: • waste diversion of 27% to 32%	Lowest due to: • waste diversion of 28% to 33%	Second lowest due to: • waste diversion of 43% to 53% (with source reduction over time)	Second lowest due to: • waste diversion of 48% to 61% (with source reduction over time) • markets are unstable	Second highest due to: • waste diversion of 61% to 69% (with source reduction over time) • high level of source separation is likely to increase market value of secondary materials	Second highest due to: • waste diversion of 60% to 68% (with source recuction over time)	Highest due to: • waste diversion of 78% to 84% (16% disposed) • limited source separation decreases market value of secondary materials

Social Acceptability	Third highest due to: • maintain or small positive increase in 3Rs behaviour • no changes to the system; residents are familiar with it • not likely to encourage greater individual action • costs acceptable to residents and municipalities if current subsidies continue • reuse are not emphasized to extent possible	Third highest due to: • small positive increase in 3Rs behaviour • minor changes to the system; residents are familiar with it • not likely to encourage greater individual action • costs acceptable to residents and municipalities if current subsidies continue • reuse are not emphasized to the extent possible	Second highest due to: • potential to encourage greater participation by individuals in 3Rs • potential for controversy for some municipalities • difficult to implement user pay and composting in high density housing and unlikely to significantly increase participation in high-rises (represent a low proportion of households in Durham)	Highest due to: • residents and municipalities are familiar with the system • suitable to the low density character and ethnic homogeneity of Durham • costs are acceptable if current level of subsidies continue. If subsidies do not continue municipal costs may not be acceptable and service may be reduced, reducing the effectiveness of the system	Second highest due to: • suitable for the low density urban areas of Durham • ethnic homogeneity suggests more efficient education/ promotion program • application to and acceptance in apartments uncertain • potential for reduced acceptability due potential nuisance effects from food waste composting facility • potential for reduced participation by some groups due to greater difficulty using 90 gal. bins (e.g.. elderly) • residents may not separate high proportion of food waste, particularly in winter • potential for less contamination of recyclables than mixed waste processing	Lowest due to: • processing and composting facility operation likely to be unacceptable • system does not encourage source separation; could reduce participation in blue box and household composting • residents and municipalities are willing/unable to pay for the high capital costs • potential for higher contamination of recyclables than the other systems may reduce the usability of the recyclables	Lowest due to: • processing and composting facility operation likely to be unacceptable • system does not encourage source separation; could reduce participation in blue box and household composting • residents and municipalities are unlikely/unable to pay for the high capital costs • potential for higher contamination of recyclables than the other systems may reduce the usability of the recyclables

Reliability
Since the technology has been proven (specifically for the Region of Durham) and the systems are diverse, Systems 1 and 2 (Existing and Existing/Committed) were ranked highest for reliability. Systems 3 and 4 (Direct Cost and Expanded Blue Box respectively) were equal, and second highest ranked. System 3 Direct Cost is based on an approach that is proven in North America and it is based, to a degree, on reliance on a single approach. System 4 Expanded Blue Box is also based on proven technology, as it has proven successful in Centre and South Hastings in Ontario and it relies extensively on public participation for its success.

System 5 (Wet/Dry) is ranked second lowest as it relies on extensive public participation and while technology is proven, it has only been proven full scale in two small counties in Minnesota. Municipal wet/dry collection has not been proven on a full scale in a large community (comparable to GTA Regions) or anywhere in Ontario.

Systems 6A and 6B (Mixed Waste Processing with low and high quality finished product) were ranked equally and lowest because they are based on technology that is somewhat unproven to have operated successfully, because it relied on a single approach for the third bag of waste.

Flexibility
Systems 6A and 6B (Mixed Waste Processing with low and high finished compost quality) were ranked highest for Flexibility because they can accommodate the full range and quantity of residential materials generated in Region of Durham. Although there is some question about the ultimate fate of secondary materials from mixed waste processing plants, both systems were judged to be compatible with the existing collection system and lead to significantly increased waste diversion.

System 5 (Wet/Dry) was ranked second highest as it collects a wider range and greater quantity of dry materials that are not regularly collected in blue box programs. In addition, it provides a convenient method of diverting significant quantities of wet waste from disposal and is therefore more flexible than all other systems except mixed waste processing. It was limited by its requirement of new facilities in Durham region (a new central composting facility which is not currently planned and possibly additional expansions on construction of a new regional MRF) and the fundamental changes required to the existing system for residential participation. System 4 (Expanded Blue Box) was judged third highest. While it collects a wider range and quantity of materials and is compatible with the Existing/Committed system, the overall projected quantities of materials collected are lower than some systems and it will require a shift in Durham region, from bi-weekly to weekly collection of recyclables.

Systems 1, 2 and 3 (Existing, Existing/Committed and Direct Cost) are each ranked as lowest. Although each are compatible with the existing system, they do not markedly expand the range or quantities of materials collected.

Performance
System 6B (Mixed Waste Processing with high quality finished compost) was ranked highest due to its ability to divert significant quantities of residential waste (up to 84%). Systems 5 (Wet/Dry) and 6A (Mixed Waste Processing with low quality finished product) were ranked as second highest with System 5 slightly ahead of System 6A for Performance, due to a higher quantity of materials diverted (61% -69% for System 5 compared to 60% - 68% for System 6A), all ranges including source reduction.

Systems 3 (Direct Cost) and System 4 (Expanded Blue Box) are ranked equal and second lowest. Whereas System 4 has potential to attain slightly higher diversion (48% - 61% compared to 43% - 53% for Direct Cost) it's performance may be reduced by unstable markets for materials.

The range reflects some uncertainty in the level of source reduction achievable by the year 2000. This has been estimated at 5% based on 1992 base case rates, for the purpose of this study. The level of participation in backyard composting is also somewhat uncertain. The higher diversion estimate assumes that 80% of single family households would divert up to 240 kg/hh/year, the lower rate assumes that some households would average a reduced rate of 100 kg/hh/year through backyard composting.

Systems 1 (Existing) and System 2 (Existing/Committed) are both ranked lowest due to the low level of material diverted. System 1 diverts up to 32% and System 2 would divert up to 33% of materials.

Social Acceptability
Based on the Social Acceptability indicators, System 4 was ranked highest because residents and municipalities are familiar with the system components and can be expected to respond more quickly and more positively to the system. System 4 is also suitable for the low density character of Durham; it will provide an improved level of service to residents (e.g., weekly collection of the blue box) which is likely to encourage greater participation; and, costs are acceptable, assuming current levels of subsidy continue.

Systems 3 and 5 were ranked second highest because they both have the potential to encourage greater participation in 3Rs and both are suitable for low density urban areas of Durham. However, there are uncertainties for both systems concerning the participation by apartment households and effects in rural areas. Both systems are ranked higher than systems 1, 2 and 6 because they

have greater potential to encourage stronger positive attitudes and behaviour toward the 3Rs.

Systems 1 and 2 are ranked third highest because, although residents are familiar with the components of the systems and costs are acceptable (if current subsidies continue), they are unlikely to increase participation by individuals in 3Rs activities as much as systems 3, 4, and 5.

System 6 was ranked lowest because the mixed waste processing and composting facility operation is unlikely to continue to operate due to odor problems; it does not encourage source separation and could reduce individual participation in some of the components of the system (e.g. Blue Box). In addition, the costs for the mixed waste processing and composting facility are likely to be unacceptable to residents and municipalities. No distinction was made between Systems 6A and 6B.

OVERALL SYSTEM RANKING

In the Region of Durham, the System ranking under the service criteria grouping was:

Highest	System 4 - Expanded Blue Box
Second highest	System 5 - Wet/Dry
Second lowest	System 3 - Direct Cost
Lowest	System 1 - Existing
	System 2 - Existing/Committed
	System 6A - Solid Mixed Waste Processing (low quality)
	System 6B - Solid Mixed Waste Processing (high quality)

In the Region of Durham, Systems 6A and 6B (Mixed Waste Processing, low and high quality compost) were ranked highest and second highest for performance, but lowest for reliability. They were therefore eliminated from consideration as the highest ranked system. The same was true (in reverse) for the existing and the Existing/Committed systems.

Therefore Systems 3, 4, and 5 were compared to determine the highest ranking, and then the other two systems were ranked. System 4 (Expanded Blue Box) was ranked highest (on Social Acceptability), highest on reliability, and third lowest on performance. It was therefore ranked highest overall. System 5 (Wet/Dry) was ranked second lowest on each of Performance, Social Acceptability and Flexibility, with second highest rank for Reliability. It was therefore ranked second highest overall. System 3 (Direct Cost) was considered second lowest overall. It was ranked second highest for Reliability and Social Acceptability, second lowest for performance, and lowest for flexibility (as it handles a narrower range of materials).

Systems 1 (Existing) and 2 (Existing/Committed) were ranked lowest overall. They were ranked similarly, highest reliability, third highest for reliability, third highest for social acceptability and lowest for both performance and flexibility.

Systems 6A and 6B were ranked lowest overall. They were ranked similarly and highest for flexibility and lowest for both reliability and social acceptability. System 6A was ranked highest, and System 6B was ranked second highest for performance.

7.3.2 Residential Systems for Metro Toronto

Table 7.4 presents a comparative evaluation of systems for the Metro Toronto and summarizes system ranking by service criterion, and overall system ranking for Metro Toronto.

Reliability
Since the technology has been proven (specifically for Metro Toronto) and the systems are diverse, Systems 1 and 2 (Existing and Existing/Committed) were ranked equally highest with respect to reliability. Systems 3 and 4 (Direct Cost and Expanded Blue Box respectively) were equal, and second highest. System 3, Direct Cost, is based on an approach that is proven in North America and it is based, to a degree, on reliance on a single approach. System 4, Expanded Blue Box, is also based on proven technology, as it has proven successful in Centre and South Hastings in Ontario. It relies extensively on public participation for its success. Also, Metro residents are presently participating in a partially expanded program (telephone books, magazines, OCC, some plastics) which has been successful.

System 5 (Wet/Dry) is ranked second lowest as it relies on extensive public participation and while technology is proven, it has not been proven on a full scale in a large jurisdiction anywhere in Ontario or North America, and it may be limited in its ability to include multi-family buildings. Because multi-family units make up a significant proportion of Metro's housing stock, this is considered a limitation of the system. Extensive research has been carried out on wet/dry systems in the Regions of Peel, Halton, and also in Metro, through a series of pilot projects carried out on an on-going basis for the last two years.

Systems 6A and 6B (Mixed Waste Processing with low and high quality finished compost) were both ranked lowest because they are based on a technology that is somewhat unproven to have operated successfully anywhere in North America without periodic plant shutdowns due to odour problems and, or operational problems. Systems 6A and 6B rely on a single approach for the "third bag" of waste. This approach is being abandoned in Europe, having been used there for the processing of municipal waste for the last 40 years.

METROPOLITAN TORONTO
NET EFFECTS SUMMARY FOR SERVICE

Goal/Criteria Group/Criteria	System 1 Existing	System 2 Existing Committed	System 3 Direct Cost	System 4 Expanded Blue Box	System 5 Wet/Dry	System 6a) Mixed Waste Processing (low quality compost)	System 6b) Mixed Waste Processing (high quality compost)
IMPACT:							
Service	Second lowest	Third lowest	Second highest	Highest	Third highest	Lowest	Lowest
Reliability	Highest due to: • technologies presently exist and are proven • success is not due to reliance on single approach	Highest due to: • technologies presently exist and are proven • success is not due to reliance on a single approach	Second highest due to: • technologies presently exist and are proven • success is not due to reliance on a single approach • success partially dependent on participation in additional source separation by residents	Second highest due to: • technologies presently exist and are proven • success is not due to reliance on a single approach	Second lowest due to: • technology proven in Europe but not yet in North America at full scale • limited ability to include multi-family • depends on one primary approach • relies on significantly increased public participation	Lowest due to: • unproven technology that is not fully successful anywhere in North America at present • applies single approach to third bag of waste • recovered materials of poorer quality - creates marketing problems • very large mixed waste plant (900,000 tonnes/yr) required • compost of poor quality and is landfilled	Lowest due to: • unproven technology that is not fully successful anywhere in North America at present • applies single approach to third bag of waste • recovered materials of poorer quality - creates marketing problems • very large mixed waste plant (900,000 tonnes/yr) required

Flexibility	Lowest due to: • flexibility limited at present by range of dry materials accepted, and inability to divert significant quantities of organics	Second lowest due to: • new MRF will provide increased processing capacity • new recycling depot provides more opportunity to divert/re-use range of materials • increase in materials collected expected due to addition of some multi-family recycling • partially expanded range of materials will be maintained • proposed composting facility provides processing capacity for organics • new materials (fine paper, pizza boxes, polycoat) added to Blue Box)	Third lowest due to: • basic compatibility with existing system • additional quantities of materials generated will be processed in new MRFs • increased range of dry materials can be accommodated • collection of wet wastes not provided	Third highest due to: • basic compatibility with existing system • can phase project in gradually • uses basis of existing/ committed system. • larger range of dry materials collected	Second highest due to: • collection of wider range and greater quantity of materials: (including wet waste and other dry materials not captured in residential blue box programs • proposed MRFs and composting facility in existing/ committed provide capacity to process materials • compatible with existing/ committed system	Highest due to: • ability to handle full range of wastes generated • provides ability to divert both wet and dry wastes • not compatible with existing/ committed system • compatible with existing collection system	Highest due to: • ability to handle full range of wastes generated • provides ability to divert both wet and dry wastes • not compatible with existing/ committed system • compatible with existing collection system
Performance	Lowest due to: • limited waste diversion of 19% or up to 24% with source reduction over time	Lowest due to: • limited waste diversion of only 21% or up to 26% with source reduction over time	Second lowest due to: • estimated waste diversion of 33% or up to 47% with source reduction over time	Third highest due to: • estimated waste diversion of 37% or up to 53% with source reduction over time	Second highest due to: • estimated waste diversion of 49% or up to 67% with source reduction over time	Second highest due to: • estimated waste diversion of 54% or up to 60% with source reduction over time	Highest due to: • potential for 74% to 79% waste diversion

Social Acceptability	Second lowest due to: • maintain or small positive increase in 3Rs behaviour • no changes to the system; residents are familiar with it • not likely to encourage greater individual action • costs acceptable to residents and municipalities if current subsidies continue	Third highest due to: • positive increase in 3Rs behaviour • minor changes to the system; residents are familiar with it • likely to encourage greater individual action • costs acceptable to residents and municipalities if current subsidies continue • suitable to high density housing	Second highest due to: • potential to encourage greater participation by individuals in 3Rs • potential for controversy for some municipalities • potential for controversy reduced if education and consultation program implemented and appropriate user pay options selected • difficult to implement user pay and composting in high density housing and unlikely to significantly increase participation in high-rises	Highest due to: • level of participation in composting and recycling in multi-family households is uncertain • residents and municipalities are familiar with and accepting of the system and the infrastructure is in place • costs are acceptable if current level of subsidies continue. If subsidies do not continue municipal costs may not be acceptable and service may be reduced, reducing the effectiveness of the system	Third lowest due to: • acceptance of most components of the system • suitable for low density areas of Metro • acceptability of the system may be affected by odour, health and vermin effects from food waste composting facilities • residents may not separate high proportion of food waste, particularly in winter • potential for contamination of recycle and compost streams because people are unwilling, unable or lack knowledge to source separate properly • potential for a variety of inconveniences which may reduce its popularity • uncertain of application of wet/dry system in multi-family • attaining high levels of participation difficult for elderly, disabled, multi-family households, and in the initial phase some language groups	Lowest due to: • potential for processing and composting facility operation to be unacceptable • system does not encourage source separation; could reduce participation in blue box and household composting • residents and municipalities may be unlikely/unable to pay for the high capital costs • potential for higher contamination of recyclables than the other systems because people are unable, unwilling or lack knowledge to source separate properly	Lowest due to: • potential for processing and composting facility operation to be unacceptable • system does not encourage source separation; could reduce participation in blue box and household composting • residents and municipalities may be unlikely/unable to pay for the high capital costs • potential for higher contamination of recyclables than the other systems because people are unable, unwilling or lack knowledge to source separate properly

Flexibility
Systems 6A and 6B (Mixed Waste Processing with low and high finished compost quality) were ranked highest for flexibility because they can handle the full range and quantity of residential materials generated in Metro Toronto. Although there is some question about the ultimate fate of secondary materials from mixed waste processing plants, both systems were judged to be compatible with the existing collection system and to lead to significantly increased waste diversion.

System 5 (Wet/Dry) was ranked second highest as it collects a wider range and greater quantity of dry materials that are not regularly collected in Blue Box programs. The proposed composting facility in the Existing/Committed system provides the capacity to process the organics recovered by this system. The proposed MRF in the Existing/Committed System may provide adequate capacity to process the increased range and quantity of dry materials recovered by this system. (Neither of these facilities are likely to be constructed within the next five years). In addition, System 5 provides the capacity to divert significant quantities of wet household (food) waste, which can not be diverted by Systems 1 to 4. This system therefore has greater flexibility than Systems 1 to 4.

System 4 (Expanded Blue Box) was ranked third highest. While it collects a wider range and quantity of dry materials and is compatible with the Existing/Committed system, the overall projected quantities of materials collected are lower than in some systems. In addition, it does not have the flexibility to divert significant quantities of wet materials. City of Toronto currently collects some of the list of Expanded Blue Box materials, hence System 4 would not require a significant change in behaviour for some metro residents.

System 3 (Direct Cost) is ranked third lowest. It is compatible with the existing system. Processing capacity is likely available under the Existing/Committed System for the additional quantities of materials that the system would generate. It is ranked higher than System 2 because it diverts the same range of materials, but in higher quantities. System 2 (Existing/Committed) is ranked second lowest. While compatible with the Existing System, it will handle only a slightly increased range of materials. System 1 (Existing) is ranked lowest because it diverts a limited range and quantity of materials.

Performance
System 6B was ranked highest with respect to performance because it significantly increases the amount of material diverted, despite the fact that the potential lower quality of secondary materials may reduce their marketability. For this system, it was assumed that markets/end uses could be found for all of the finished compost, resulting in an overall diversion rate of 74% to 79%.

System 6A (Mixed Waste Processing with low quality finished compost) was ranked as second highest, along with System 5 (Wet/Dry). System 6A is slightly ahead of System 5 with potential to divert 54% to 60% as opposed to 49% to 67% of the residential waste stream.

System 3 (Direct Cost) and System 4 (Expanded Blue Box) are ranked second lowest and third highest respectively. System 3 offers diversion potential between 33% and 47% while system 4 has potential to divert between 37% and 53% of the residential waste stream. The range reflects some uncertainty in the level of source reduction achievable by the year 2000. This has been estimated at 5% based on 1992 base case rates, for the purpose of this study.

System 1 (Existing) and System 2 (Existing/Committed) are ranked lowest, due to the lower level of material diverted. With a range of 19% to 24% (Existing) and 21% to 26% (Existing/Committed), respectively, and including source reduction, both are below the provincial diversion target of 50%.

Social Acceptability

System 4 (Expanded Blue Box) was ranked highest for Social Acceptability because residents and municipalities are familiar with the system components and the infrastructure, and can be expected to respond more quickly and more positively to the system. System 4 appears to be more suitable to the broad range of housing density patterns in Metro than either Systems 3 or 5, equal to System 6 and more comprehensive than either Systems 1 or 2. Therefore System 4 should lead to increased participation, improved attitudes and perceptions and a willingness to pay.

System 3 was ranked second highest because it has greater potential to encourage positive attitudes, perceptions and participation than Systems 1, 2 and possible 5 and 6. There are likely to be some initial negative attitudes associated with direct cost; however, with the proper selection of system and significant public consultation, these negative concerns should be reduced in the long term. The implementation of direct cost in high-rise apartments may be ineffective in increasing participation in recycling programs beyond that of Existing/Committed System. Because direct cost may increase participation in low density areas of Metro over Existing/Committed, it ranks higher, although the difference between the two systems is not great.

System 2 was ranked third highest because it supports current 3Rs behaviors, and may encourage additional positive attitudes and perceptions. Costs of this system are acceptable to residents and municipalities if current subsidies continue.

System 5 was ranked third lowest. In the low-density areas of Metropolitan Toronto, this system may be acceptable with strong participation and some

increase in positive attitudes, although with some concerns about the convenience of the system. In Metro's high-density areas this system may meet negative attitudes and concerns about costs and an unwillingness to participate. The concerns will be focused primarily on the health, odour and nuisance effects of the "wet" stream and how it is collected, managed and disposed in high-rise apartments. Apartment owners, managers and tenants may be very concerned about this system. Municipalities and residents may be concerned about the costs of this system.

System 1 was ranked second lowest. This system will only maintain or lead to a small increase in participation and positive attitudes and perceptions. Costs are acceptable to residents and municipalities if current subsidies continue.

System 6 was ranked lowest. Due to the potential odour effects, there is likely to be significant opposition to a mixed solid waste composting and sorting facility. While the components of this system are available to all households (equal to Blue Box) and it encourages 3Rs involvement, there is the potential for the system to deter many people from source separation. The convenience of disposing of all waste, knowing that it will be separated elsewhere, may prompt residents to stop separating their waste. Furthermore, residents and municipalities may be unwilling to pay for the higher costs of this system.

In Metro Toronto, the system ranking under the service criteria grouping was:

OVERALL SYSTEM RANKING

Highest	System 4 - Expanded Blue Box
Second highest	System 3 - Direct Cost
Third highest	System 5 - Wet/Dry
Third lowest	System 2 - Existing/Committed
Second lowest	System 1 - Existing
Lowest	Systems 6A - Mixed Waste Processing (low quality)
	System 6B - Mixed Waste Processing (high quality)

In Metro Toronto, systems 6A and 6B received a highest and second highest ranking for performance, but a lowest ranking for reliability, and were therefore eliminated from consideration as the lowest ranked system. The same was true (in reverse) for the Existing and the Existing/Committed Systems.

Systems 3, 4, and 5 were then compared to determine the highest ranking, and then the other two systems were ranked. System 4 (Expanded Blue Box) was ranked highest (on Social Acceptability), second highest on reliability, and third highest on performance and was therefore ranked highest overall. Systems 3 and 4 were considered equal, based on the two most important criteria (performance and reliability) and were then compared using other criteria. System 3 is ranked second highest for social acceptability, whereas System 5 is second lowest.

System 5 is ranked second highest for flexibility, compared to System 3 which is second lowest. Because social acceptability is considered more important than flexibility, System 3 ranked higher than System 5. Therefore System 3 is second highest, and System 5 is third highest ranked overall.

System 5 received a higher ranking than Systems 3 and 4 for performance (due to its higher diversion potential) but a lower ranking on reliability. It was considered similar to System 3, receiving a second highest score for performance combined with a second lowest score for reliability.

System 2 (Existing/Committed) is ranked third lowest. This ranking is determined by comparing System 2 to System 5. System 2 is more socially acceptable than System 5, but because it received a lowest ranking for performance (one of the two most important criteria) it is ranked lower than System 5.

System 1 (Existing) is ranked higher than Systems 6A and 6B (ranked lowest), but receives low rankings for performance, social acceptability and flexibility. Its diversion potential is estimated at 21 to 26%, which is significantly below the provincial 50% target. It is therefore ranked second lowest overall.

Mixed Waste Processing Systems 6A and 6B were ranked lowest overall. While they received a rank of second highest and highest on performance (for 6A and 6B respectively), they were each ranked lowest on reliability (a top criterion) and social acceptability. Both were ranked highest for flexibility, but this is the criterion considered of least importance.

7.3.3 Residential Systems for Region of York

Table 7.5 presents a comparative evaluation of systems for the Region of York and summarizes system ranking by service criterion, and overall system ranking for the Region of York.

Reliability
Since the technology has been proven (specifically for the Region of York) and the systems are diverse, Systems 1 and 2 (Existing and Existing/Committed) were judged to be equal and ranked highest in terms of Reliability. Systems 3 and 4 (Direct Cost and Expanded Blue Box respectively) were equal, and second highest. System 3 Direct Cost is based on an approach that is proven in North America and it is based, to a degree, on reliance on a single approach.

System 4 Expanded Blue Box is also based on proven technology, as it has proven successful in Centre and South Hastings in Ontario and it relies extensively on public participation for its success. Also, some Region of York

TABLE 7.5
REGION OF YORK
NET EFFECTS SUMMARY FOR SERVICE

Goal/Criteria Group/Criteria	System 1 Existing	System 2 Existing Committed	System 3 Direct Cost	System 4 Expanded Blue Box	System 5 Wet/Dry	System 6a) Mixed Waste Processing (low quality compost)	System 6b) Mixed Waste Processing (high quality compost)
IMPACT:							
Service	**Second lowest**	**Third lowest**	**Second highest**	**Highest**	**Third highest**	**Lowest**	**Lowest**
Reliability	Highest due to: • technologies presently exist and are proven • success is not due to reliance on single approach	Highest due to: • technologies presently exist and are proven • success is not due to reliance on a single approach	Second highest due to: • technologies presently exist and are proven • success is not due to reliance on a single approach • success partially dependent on participation in additional source separation by residents	Second highest due to: • technologies presently exist and are proven • success is not due to reliance on a single approach • markets may be limited for some materials	Second lowest due to: • technology proven in Europe but not yet in North America at full scale • relies on significantly increased public participation	Lowest due to: • unproven technology that is not fully successful anywhere in North America at present • applies single approach to third bag of waste • recovered materials of poorer quality - creates marketing problems • compost of poor quality and is landfilled	Lowest due to: • unproven technology that is not fully successful anywhere in North America at present • applies single approach to third bag of waste • recovered materials of poorer quality - creates marketing problems

Flexibility	Lowest due to: • flexibility limited at present by range of dry materials accepted, and inability to divert significant quantities of organics • nothing committed that will provide for increased diversion	Lowest due to: • nothing committed that will provide for increased diversion • low % of multi-family dwellings means not much opportunity to increase diversion through their inclusion • new MRF will merely replace 2 existing facilities	Second lowest due to: • basic compatibility with existing system • additional quantities of materials generated will be processed in new MRFs • collection of wet wastes not provided	Third highest due to: • compatibility with existing system • can phase project in gradually • uses basis of existing/commi tted system. • new MRF would have to have capacity to process wider range and larger quantity of materials	Second highest due to: • collection of wider range and greater quantity of materials: (including wet waste and others not captured in residential blue box programs) • proposed MRF in existing/ committed will have to provide capacity to process additional secondary materials	Highest due to: • ability to handle full range of wastes generated • provides ability to divert both wet and dry wastes not compatible with existing/commi tted system • compatible with existing collection system	Highest due to: • ability to handle full range of wastes generated • Compatible with existing collection system
Performance	Lowest due to: • limited waste diversion of only 28% or up to 33% with source reduction over time	Lowest due to: • limited waste diversion of only 28% or up to 33% with source reduction over time	Second highest due to: • waste diversion of 44% or up to 55% with source reduction over time	Second highest due to: • waste diversion of 49% or up to 61% with source reduction over time	Highest due to: • waste diversion of 61% or up to 70% with source reduction over time	Highest due to: • waste diversion of 60% or up to 68% with source reduction over time	Highest due to: • estimated ability to divert 78% to 84% waste with source reduction over time

Social Acceptability	Second lowest due to: • maintain or small positive increase in 3Rs behaviour • no changes to the system; residents are familiar with it • not likely to encourage greater individual action • costs acceptable to residents and municipalities if current subsidies continue • reduction and reuse not emphasized to the same extent as other systems (no education programs)	Third highest due to: • potential for only small positive increase in 3Rs behaviour • no changes to the system for households except for the addition of apartment recycling; residents are familiar with it • not likely to encourage greater individual action • costs acceptable to residents and municipalities if current subsidies continue • reduction and reuse are not emphasized to the same extent as other systems	Second highest due to: • potential to encourage greater participation by individuals by source separating more materials for recycling and composting and with more households provided with composters • potential for controversy for some municipalities in the short term • potential for controversy reduced if education and consultation program implemented and appropriate user pay options selected for the Region • difficult to implement user pay and composting in high density housing; unlikely to significantly increase participation in high rises (represent a low proportion of households in York) • potential for illegal dumping	Highest due to: • residents and municipalities are familiar with the system; infrastructure is in place • suitable to the low density character; education program would be targeted to different language or cultural groups • costs are acceptable if current level of subsidies continue. If not, municipal costs may not be acceptable and service may be reduced, decreasing the effectiveness of the system	Third Highest due to: • suitable for the low density urban areas of York • ethnic homogeneity suggests more efficient education/ promotion program • potential for less contamination of recyclables than mixed waste processing • application to and acceptance in apartments and rural areas uncertain (about 20% of population) • potential for reduced acceptability due to potential nuisance effects from large volumes of food waste at the composting facility • potential for reduced participation by some groups due to greater difficulty using 90 gal. bins and greater inconveniences (eg. elderly and rural residents) • residents may not separate high proportion of food waste, particularly in winter • at the higher costs residents and municipalities may be unwilling or unable to pay for the system	Lowest due to: • processing and composting facility operation likely to be unacceptable • system does not encourage source separation; could reduce participation in blue box and household composting • residents and municipalities are unwilling/unable to pay for the high capital costs • potential for higher contamination of recyclables than the other systems may reduce the usability of the recyclables	Lowest due to: • potential for processing and composting facility operation to be unacceptable • system does not encourage source separation; could reduce participation in blue box and household composting • residents and municipalities are unwilling/unable to pay for the high capital costs • potential for higher contamination of recyclables than the other systems may reduce the usability of the recyclables

residents (in Markham) are presently participating in a partially expanded program which has been successful.

System 5 (Wet/Dry) is ranked second lowest as it relies on extensive public participation and while technology is proven, it has not been proven on a full scale anywhere in Ontario or North America, and it may be limited in its ability to include multi-family buildings. Because Region of York has a low percentage of multi-family households, this is not considered a significant limitation of the system. Extensive research has been carried out on wet/dry systems in Region of Peel, through a series of pilot projects carried out on an on-going basis for the last two years. Some communities in York (Markham, Newmarket) are aggressively pursuing wet/dry projects, and hope to have systems in place in the near future.

Systems 6A and 6B (Mixed Waste Processing with high and low quality finished compost) were both ranked lowest because they are based on a technology that is somewhat unproven to have operated successfully anywhere in North America using the study criteria for mixed waste processing.

Systems 6A and 6B rely on a single approach for the "third bag" of waste. This approach is being abandoned in Europe, having been used there for processing of municipal waste for the last 40 years.

Flexibility
System flexibility was judged according to the types and quantities of waste accommodated and compatibility with the existing system. This criterion incorporates the ability of the system to adapt to changing waste characteristics and quantities.

Systems 6A and 6B (Mixed Waste Processing with low and high finished compost quality) were ranked highest because they can handle the full range and quantity of residential materials generated in Region of York. Although there is some question about the ultimate fate of secondary materials from mixed waste processing plants, both systems were judged to be compatible with the existing collection system and to lead to significantly increased waste diversion.

System 5 (Wet/Dry) was ranked second highest as it collects a wider range and greater quantity of dry materials that are not regularly collected in Blue Box programs. The proposed MRF in the Existing/Committed System is likely to provide the capacity to process the expanded list of dry materials recovered by this system. Composting facilities being proposed in the Region by private sector companies could likely provide the organic processing capacity required for this system. These have not been included in the assessment at this time as their status is somewhat uncertain. System 5 provides the capacity to divert

significant quantities of wet household waste which cannot be diverted by Systems 1 to 4. This system therefore has greater flexibility than Systems 1 to 4.

System 4 (Expanded Blue Box) was ranked third highest. While it collects a wider range and quantity of dry materials and is compatible with the Existing/Committed System, in the Region of York projected quantities of materials collected are lower than in some systems. In addition, it does not have the flexibility to divert significant quantities of wet materials. Some York communities (e.g. Markham) currently collect most of the list of expanded Blue Box materials, hence System 4 would not require a change in behaviour for some residents.

System 3 (Direct Cost) is ranked second lowest. It is compatible with the existing system and the new MRF can likely process the additional quantities of materials that the system would generate. System 2 (Existing/Committed) is ranked lowest along with System 1 (Existing), because of the limited range and quantities of materials it diverts.

Performance
System 6B was ranked highest in terms of performance because it significantly increases the amount of material diverted (78% to 84%) despite the fact that the potential lower quality of secondary materials may reduce their marketability. System 6A (Mixed Waste Processing with low quality finished compost) was also ranked highest, along with System 5 (Wet/Dry). System 5 has potential to divert 61%-70% while System 6A has potential to divert 60% to 68% of the residential waste stream.

Systems 3 (Direct Cost) and System 4 (Expanded Blue Box) are both ranked second highest, with diversion potential of 44% to 55% (System 3) and 49% to 56% (System 4). The range reflects some uncertainty in the level of source reduction achievable by the year 2000. This has been estimated at 5% based on 1992 base case rates, for the purpose of this study. The level of participation in backyard composting is also somewhat uncertain. The higher diversion estimate assumes that 80% of single family households would divert up to 240 kg/hh/year, while the lower rate assumes that some households would average a reduced diversion rate of 100 kg/hh/year through backyard composting.

Systems 1 (Existing) and System 2 (Existing/Committed) are ranked lowest, due to the lower level of material diverted. These systems are both estimated to divert 28% to 33% of the residential waste stream, which is below the provincial diversion target of 50%.

Social Acceptability
Based on the Social Acceptability indicators, System 4 was ranked highest because residents and municipalities are familiar with the system components

and the infrastructure and can be expected to respond more quickly and more positively to the system. System 4 appears to be more suitable to the broad range of housing types in York than either Systems 3 or 5, equal to System 6 and offers a more comprehensive service than Systems 1 or 2. Therefore, this system provides greater opportunity to participate, improved attitudes and behaviour and greater willingness to pay. Costs are acceptable, assuming that current levels of subsidy continue.

System 3 was ranked second highest because it has the potential to encourage greater participation in 3Rs than either Systems 1 or 2. The costs also appear to be acceptable and it is suitable for low density urban and rural areas of York (all rural residents have "curbside" collection of garbage). The implementation of direct cost in apartments (about 11% of households) may be ineffective in encouraging greater participation than System 2 due to implementation difficulties. System 3 has the advantage over System 2 of potentially encouraging greater participation by individuals and greater behavioural change to support 3Rs in low density areas (about 89% of households). However, it may be controversial in some municipalities and there may be initial opposition from residents. An effective education and public consultation program may be required to identify and address the public concerns related to direct cost. Through the consultation program the best approach for the Region may be identified, including a corresponding reduction in taxes or a charge for extra bags per household.

Systems 2 and 5 are ranked third highest. System 2 supports the current 3Rs behaviour, and people are familiar with the system. However, it is unlikely to encourage greater individual or municipal behaviour to reduce, reuse or recycle their waste. In addition, although it has a cost acceptability advantage over System 6, the cost for Systems 2, 3, 4 and 5 appear to be equally acceptable.

System 5 is more broadly based and has slightly potential for greater participation. It is ranked higher than Systems 1, 2 and 6 because it has potential to encourage stronger positive attitudes and behaviour toward the 3Rs. The acceptability of System 5 could be reduced due to odour and vermin effects from the volumes of food waste being composted at a composting facility. It is possible that some groups will participate less due to greater difficulty in using the 90 gallon bins (e.g. elderly and disabled) and for others not to separate food waste (due to the messiness and inconveniences associated with the bins and cleaning them). In addition, the effectiveness of the wet/dry system in rural areas, representing about 20% of the population, is uncertain. At the higher cost of System 5, it may be less acceptable since residents and municipalities may be unwilling to pay the higher costs for the system. System 1 was ranked second lowest because, although the costs of the system are likely to be acceptable, it is not likely to encourage greater individual 3Rs action, and will not significantly encourage reduction and reuse.

System 6 was ranked lowest because the costs for the mixed waste processing and composting facility are likely to be unacceptable to residents and municipalities; it does not encourage source separation and could reduce individual participation in some of the components of the system (e.g. Blue Box); and, the mixed waste processing and composting facility operation is unlikely to continue to operate due to odour problems.

In the Region of York, the system ranking under the service criteria grouping was:

OVERALL SYSTEM RANKING

Highest	System 4 - Expanded Blue Box
Second highest	System 3 - Direct Cost
Third highest	System 5 - Wet/Dry
Third lowest	System 2 - Existing/Committed
Second lowest	System 1 - Existing
Lowest	Systems 6A - Mixed Waste Processing (low quality)
	System 6B - Mixed Waste Processing (high quality)

Systems 6A and 6B received the highest ranking for performance, but the lowest ranking for reliability, and were therefore eliminated from consideration as the highest ranked system. The same was true (in reverse) for the Existing System.

System 4 (Expanded Blue Box) was ranked highest on social acceptability, second highest on reliability and performance, and was therefore ranked highest overall in the Region of York. System 3 (Direct Cost) was ranked second highest. It received a similar ranking to System 4 for reliability and performance, but was considered less socially acceptable. It also received a lower ranking than System 4 for flexibility (as it handles a narrower range of materials).

System 5 (Wet/Dry) was ranked third highest. System 5 received a higher ranking than Systems 3 and 4 for performance (due to its higher diversion potential) but a lower ranking on reliability. This combination resulted in the system being evaluated on other criteria. It was considered third highest ranked for social acceptability. It was considered more flexible than Systems 3 and 4, but because flexibility is less important, it received a third highest rating.

Mixed Waste Processing Systems 6A and 6B were ranked lowest overall. While they received a highest rank on Performance, they were each ranked lowest on reliability (a top criterion) and social acceptability. Both were considered highest ranked for flexibility, but this is the criterion ranked highest of least importance.

Systems 1 and 2, Existing and Existing/Committed systems were ranked lowest for performance and highest for reliability. These were therefore considered

equal to Systems 6A and 6B for a highest and lowest score combination for these two criteria. They are considered more socially acceptable and less flexible than Systems 6A and 6B. Because social acceptability is considered a more important criterion, it was used to differentiate between the two systems. System 1 was therefore ranked second lowest, and System 2 third lowest.

7.3.4 Residential Systems for Region of Peel

Table 7.6 presents a comparative evaluation of systems for the Region of Peel and summarizes system ranking by service criterion, and overall system ranking for Region of Peel.

Reliability
Since the technology has been proven (specifically for the Region of Peel) and the systems are diverse, Systems 1 and 2 (Existing and Existing/Committed) were ranked to be equal and highest for Reliability. Systems 3 and 4 (Direct Cost and Expanded Blue Box respectively) were equal, and second highest. System 3 Direct Cost is based on an approach that is proven in North America and it is based, to a degree, on reliance on a single approach, (economic incentives to increase voluntary source separation by residents.)

System 4 Expanded Blue Box is also based on proven technology, as it has proven successful in Centre and South Hastings in Ontario and it relies extensively on public participation for its success. Also, Peel residents are presently participating in a partially expanded program which has been successful.

System 5 (Wet/Dry) is ranked second lowest as it relies on extensive public participation and while technology is proven, it has not been proven on a full scale anywhere in Ontario or North America. It may also be limited in its ability to include multi-family buildings. Because multi-family units make up a significant proportion of Peel's housing stock, this is considered a limitation of the system. Extensive research has been carried out on wet/dry systems in the Region of Peel, Halton, and also in Metro, through a series of pilot projects carried out on an on-going basis for the last two years.

Systems 6A and 6B (Mixed Waste Processing with low and high quality finished compost) were ranked equally and lowest because they are based on a technology that is somewhat unproven to have operated successfully at full scale for a period of one year, without plant shutdowns and operational problems. Mixed waste processing has not been used successfully anywhere in North America to date, without significant operational problems and occasional shutdowns. This approach is also being abandoned in Europe at this time, having been used in European jurisdictions for 40 years. Systems 6A and 6B rely on a single approach for the third bag of waste. A mixed waste system has been

Table 7.6

REGION OF PEEL
NET EFFECTS SUMMARY FOR SERVICE

Goal/Criteria Group/Criteria	System 1 Existing	System 2 Existing Committed	System 3 Direct Cost	System 4 Expanded Blue Box	System 5 Wet/Dry	System 6A Mixed Waste Processing (low quality compost)	System 6B Mixed Waste Processing (high quality compost)
IMPACT:							
Service	**Second lowest**	**Third highest**	**Second highest**	**Highest**	**Third highest**	**Lowest**	**Lowest**
Reliability	Highest due to: • technologies presently exist and are proven • success is not due to reliance on single approach	Highest due to: • technologies presently exist and are proven • success is not due to reliance on a single approach	Second highest due to: • technologies presently exist and are proven • success is not due to reliance on a single approach • success partially dependent on participation in additional source separation by residents	Second highest due to: • technologies presently exist and are proven • success is not due to reliance on a single approach • Peel residents presently participating in successful partially expanded program • markets are unstable	Second lowest due to: • technology proven in Europe but not yet in North America at full scale • limited ability to include multi-family • depends on one primary approach • relies on significantly increased public participation	Lowest due to: • unproven technology that is not fully successful anywhere in North America at present • applies single approach to third bag of waste • if successful, is likely compatible with existing incineration	Lowest due to: • unproven technology that is not fully successful anywhere in North America at present • applies single approach to third bag of waste

Flexibility	Lowest due to: • flexibility limited at present by range of dry materials accepted, and inability to divert organics	Second lowest due to: • new MRF provides increased processing capacity • new recycling centre provides more opportunity to divert/re-use range of materials • increase in materials collected expected due to addition of multi-family recycling • partially expanded range of materials will be maintained • proposed composting facility provides processing capacity for organics	Third highest due to: • basic compatibility with existing system • additional quantities of materials generated will be processed in new MRF • increased range of dry materials can be accommodated • collection of wet wastes not provided	Second highest due to: • compatibility with existing system (i.e. partially expanded blue box) • can phase project in gradually • increases waste diversion • uses basis of existing/committed system.	Highest due to: • collection of wider range and greater quantity of materials: (including wet waste and others not captured in residential blue box programs • proposed MRF and composting facility in existing/committed provide capacity to process secondary materials • compatible with existing/committed system	Highest due to: • provides ability to divert both wet and dry wastes • increased waste diversion • not compatible with existing/committed system • compatible with existing collection system	Highest due to: • provides ability to divert both wet and dry wastes • increased waste diversion • not compatible with existing/committed system • compatible with existing collection system
Performance	Lowest due to: • limited waste diversion of 20% to 25%	Second lowest due to: • limited waste diversion of 23% to 30%	Third highest due to: • estimated waste diversion of 40% to 52%	Third highest due to: • estimated waste diversion of 38% to 53%	Second highest due to: • estimated waste diversion of 56% to 70%	Second highest due to: • estimated waste diversion 56% to 63%	Highest due to: • estimated waste diversion of 77% to 82%

Social Acceptability	Second lowest due to: • maintain or small positive increase in 3Rs behaviour • no changes to the system; residents are familiar with it • costs acceptable for Systems 1, 2, 3, 4 and 5 to residents and municipalities if current subsidies continue • not likely to encourage greater individual action	Second highest due to: • positive increase in 3Rs behaviour • residents are familiar with the system • costs acceptable for Systems 1, 2, 3, 4 and 5 to residents and municipalities if current subsidies continue • suitable for high density housing • likely to encourage greater individual action	Second highest due to: • potential to encourage greater participation by individuals in 3Rs than Systems 1, 2, 5 and 6 • costs acceptable for Systems 1, 2, 3, 5 and 5 to residents and municipalities if current subsidies continue • potential revenue gain for System 3 to off-set other waste management costs • potential for controversy for some municipalities • difficult to implement user pay and composting in high density housing and unlikely to significantly increase participation in high-rises	Highest due to: • potential to encourage greater participation by individuals in 3Rs • residents and municipalities are familiar with the system • costs are acceptable for Systems 1, 2, 3, 4 and 5 if current level of subsidies continue • difficult to implement composting in high density housing and unlikely to significantly increase participation in high-rises	Third highest due to: • costs acceptable for Systems 1, 2, 3, 4 and 5 to residents and municipalities if current subsidies continue • application to and acceptance in apartments uncertain • potential for reduced acceptability due to potential odour, health and vermin effects from food waste at composting facilities • residents may not separate high proportion of food waste, particularly in winter • potential for less contamination of recyclables than System 6 • potential for reduced participation by some groups due to greater difficulty using 90 gal. bins (eg. elderly)	Lowest due to: • processing and composting facility operation likely to be unacceptable • residents and municipalities may be unwilling/ unable to pay the high capital costs • potential for higher contamination of recyclables than the other systems • may reduce the usability of the recyclables • system does not encourage source separation; could reduce participation in blue box and household composting	Lowest due to: • processing and composting facility operation likely to be unacceptable • residents and municipalities may be unwilling/ unable to pay the high capital costs • potential for higher contamination of recyclables than the other systems • may reduce the usability of the recyclables • system does not encourage source separation; could reduce participation in blue box and household composting

proposed for Peel by St. Lawrence Cement but the project was canceled in September 1992, when incineration of municipal solid waste was banned in Ontario.

Flexibility
Systems 6A and 6B (Mixed Waste Processing with low and high finished compost quality) were ranked highest for Flexibility because they can accommodate the full range and quantity of residential materials generated in Region of Peel. Although there is some question about the ultimate fate of secondary materials from mixed waste processing plants, both systems were judged to be compatible with the existing collection system and lead to significantly increased waste diversion.

System 5 (Wet/Dry) was also ranked highest as it collects a wide range and greater quantity of materials that are not regularly collected in blue box programs. The proposed MRF and composting facility in the Existing/Committed system provide the capacity to process both the organics and the expanded list of dry materials recovered by this system. This system has greater flexibility than Systems 1 to 4, as it can divert a significant quantity of wet wastes.

System 4 (Expanded Blue Box) was ranked second highest. While it collects a wider range and quantity of dry materials and is compatible with the Existing/Committed system, the overall projected quantities of materials collected are lower than in some systems. It does not have the flexibility to divert significant quantities of wet materials. Region of Peel currently collects most of the list of expanded Blue Box materials, hence System 4 would not require a change in behaviour for some residents.

System 3 (Direct Cost) is ranked third highest. It is compatible with the Existing System and the new MRF can process the additional quantities of materials that the system would generate. System 2 (Existing/Committed) is ranked second lowest because, while compatible with the Existing System, it will handle only a slightly increased range of materials. System 1 (Existing) is ranked lowest because it is limited in the range and quantities of materials it diverts.

Performance
System 6B was ranked as highest for performance because it significantly increases the amount of material diverted, despite the fact that the potential lower quality of secondary materials may reduce their marketability. For this system, it has been assumed that markets/end uses could be found for all of the finished compost, resulting in an overall diversion rate of 77% to 82%.

System 6A (Mixed Waste Processing with low quality finished compost) was ranked as second highest, along with System 5 (Wet/Dry). System 6A has

potential to divert 56% to 63% of the waste stream, while System 5 has potential to divert 56% to 70% (including source reduction).

Systems 3 (Direct Cost) and System 4 (Expanded Blue Box) are ranked equally as third highest, with diversion potential of 40% to 52% for System 3 and 38% to 53% for System 4 (including source reduction).

Systems 1 (Existing) and System 2 (Existing/Committed) are ranked lowest and second lowest respectively, due to the lower level of material diverted. These systems are estimated to divert 20% to 25% (Existing) and 23% to 30% (Existing Committed) of the residential waste stream (including source reduction). Both are below the provincial diversion target of 50%.

Social Acceptability
Based on the Social Acceptability indicators, System 4 was ranked highest because residents and municipalities are familiar with the system components and can be expected to respond more quickly and more positively to the system. System 4 is also suitable for the low density areas of Peel. In addition, all apartment buildings of more than 6 units will be provided with recycling service under the new 3Rs regulations, providing an improved level of service to these residents, and likely encouraging greater participation. In addition, costs are acceptable, assuming current levels of subsidy continue.

Systems 2 and 3 were ranked second highest because they both have the potential to encourage greater participation in 3Rs than System 1, the costs are acceptable for both and both are suitable for low density urban areas of Peel. Although System 3 may be difficult to implement in high density areas and may be controversial in some municipalities, it does have the advantage over System 2 of potentially encouraging greater participation by individuals and greater behavioural change to support 3Rs. Both systems are ranked higher then Systems 1, 5 and 6 (A and B) because they have greater potential to encourage stronger positive attitudes and behaviour toward the 3Rs.

System 5 is ranked third highest because, although the costs are of the same order of magnitude as for Systems 2, 3 and 4, it is unlikely to increase participation by individuals in 3Rs activities as much as Systems 2, 3, and 4. The acceptability of the system could be reduced due to odour and vermin effects from the volumes of food waste being composted at the composting facility. There is also increased potential for some groups to participate less due to greater difficulty in using the 90 gallon bins (e.g. elderly and disabled) and for others not to separate food waste (due to the messiness and inconveniences associated with the bins and cleaning them). The application and acceptance of the system in apartments is uncertain. Other wet/dry systems involving bags rather than bins may be considered to mitigate against these limitations.

System 1 is ranked second lowest because although it will maintain the current 3Rs behaviour, and people are familiar with the system, it is unlikely to encourage greater individual or municipal behaviour to reduce, reuse or recycle their waste. In addition, although this system has a cost acceptability advantage over System 6, the cost for Systems 2, 3, 4 and 5 appear to be equally acceptable.

Systems 6 was ranked lowest because the mixed waste processing and composting facility operation is unlikely to continue to operate due to odour problems; it does not encourage source separation and could reduce individual participation in some of the components of the system (e.g. Blue Box). The costs for the mixed waste processing and composting facility are likely to be unacceptable to residents and municipalities. No distinction was made between Systems 6A and 6B.

OVERALL SYSTEM RANKING

In the Region of Peel, the system ranking under the service criteria grouping was:

Highest	System 4 - Expanded Blue Box
Second highest	System 3 - Direct Cost
Third highest	System 5 - Wet/Dry
Third lowest	System 2 - Existing/Committed
Second lowest	System 1, - Existing
Lowest	Systems 6A - Mixed Waste Processing (low quality) System 6B - Mixed Waste Processing (high quality)

In the Region of Peel, systems 6A and 6B were ranked highest ranking for performance, but lowest for reliability, and were therefore eliminated from consideration as the highest ranked system. The same was true (in reverse) for the existing system.

System 4 (Expanded Blue Box) was ranked highest (on Social Acceptability), second highest on reliability, and third highest on performance, and was therefore ranked highest overall. System 3 (Direct Cost) was ranked second highest. It received a similar ranking to System 4 for reliability and performance, but was considered less socially acceptable. It also received a lower ranking than System 4 for flexibility (as it handles a narrower range of materials).

System 5 (Wet/Dry) and System 2 (Existing/Committed) were ranked third highest. System 5 received a higher ranking than Systems 3 and 4 for performance (due to its higher diversion potential) but a lower ranking on reliability. This combination results in the system being evaluated on other criteria. System 2 received a low ranking on performance, but a high ranking on reliability, and was therefore similar to System 5. System 2 receives a high rank for social acceptability. System 5 is less socially acceptable than System 2, but has

greater flexibility. Flexibility is considered the least important criterion in the service grouping, but the combination of factors results in Systems 5 and 2 being ranked equally in the service grouping.

Mixed Waste Processing Systems 6A and 6B were ranked lowest overall. While they received second highest and highest ranking on Performance (for 6A and 6B respectively), they were ranked lowest on Reliability and Social Acceptability. Both were ranked highest for flexibility, but this is the criterion considered of least importance.

System 1, (Existing) is ranked lowest for performance and highest for reliability. It is therefore considered equal to Systems 6A and 6B for a highest and lowest score combination for these two criteria. It is considered more socially acceptable and less flexible than Systems 6A and 6B. Because social acceptability is considered a more important criterion, System 1 is ranked second lowest.

7.4 IC&I Systems for the GTA

This section provides a detailed explanation of the evaluations presented in the above listed tables. For the purposes of Net Effects Assessment, the IC&I Systems evaluated were identified as follows:

System Number	System Name
1	IC&I Existing
2	IC&I Existing/Committed
3	Extended 3Rs Regulations
4	Expanded 3Rs Regulations
5	Expanded 3Rs Regulations with Organics
6	Processing of all IC&I Waste Prior to Landfilling

It should be noted that in the majority of text and tables IC&I Systems 3, 4 and 5 are referred to by abbreviated names (Extended 3Rs, Expanded 3Rs and Expanded 3Rs with Organics, respectively).

Table 7.7 presents a comparative evaluation of GTA IC&I Systems and summarizes system ranking by service criterion, and overall system ranking for Region of Durham. The system ranking is discussed below for the four service criteria used for systems evaluation. Overall system ranking for service is discussed at the end of this section.

TABLE 7.7

Greater Toronto Area
NET EFFECTS SUMMARY FOR SERVICE

Goal/Criteria Group/Criteria	IC&I System 1 Existing	IC&I System 2 Existing/ Committed	IC&I System 3 Extended 3Rs (90% Cut-off)	IC&I System 4 Expanded 3Rs	IC&I System 5 Expanded 3Rs with Organics	IC&I System 6 Processing All IC&I Waste
IMPACT:						
Service	**Second lowest**	**Third highest**	**Highest**	**Second highest**	**Third lowest**	**Lowest**
Reliability • proven technology	Highest due to: • technologies presently exist and are proven • technologies rely on voluntary source separation and recovery of recyclables	Highest due to: • technologies presently exist and are proven • impacts of 3Rs regulations proven in Rhode Island, N.Y. • success is partially dependent on the extent to which institutions are covered by regulations - it is unlikely that the regulations provide sufficient coverage to meet the 50% diversion objectives • success also depends on voluntary source separation and recovery of recyclables • success depends to some extent on effective monitoring and follow-up to ensure effective source separation and diversion	Second highest due to: • technologies presently exist and are proven • success depends on effective design of regulations to identify and regulate generators who generate most (90%) of IC&I waste • impacts of extensive 3Rs regulations not proven • effective monitoring and follow-up required to ensure effective source separation and diversion • some technical limitations on handling some materials such as plastics	Third highest due to: • technologies presently exist and are proven • success depends on effective design of regulations to identify and regulate generators who generate most (90%) of IC&I waste • impacts of extensive 3Rs regulations covering a wider range of mandated materials not proven • effective monitoring and follow-up required to ensure effective source separation and diversion • some technical limitations on handling some materials particularly plastics	Second lowest due to: • technologies presently exist and are proven • success depends on effective design of regulations to identify and regulate generators who generate most (90%) of IC&I waste • impacts of extensive 3Rs regulations covering a wide range of dry. materials, and also wet materials not proven • effective monitoring and follow-up required to ensure effective source separation and diversion • potential problems of storage for some generators of wet organics particularly small generators of food wastes	Lowest due to: • system builds on existing/committed source separation requirements • technologies presently exist to process most, but not all, materials • may not be proven at large scale • uncertainty regarding how requirement would be met by private sector companies • some technical limitations on processing some materials particularly plastics • depends on effective flow controls

Flexibility • types and quantity of wastes accepted	Lowest due to: • limited range and quantity of material diverted • range and quantity of materials accepted depends entirely on voluntary commitment	Second lowest due to: • range of dry materials handled are defined by industrial sector and are limited • both range and quantity of materials diverted will depend on the coverage of the 3Rs regulations • increased processing capacity will be provided by private sector	Third lowest due to: • designed to divert virtually all of the most easily recovered and marketable dry materials • both range and quantity of materials are defined by the extended regulations • increased processing capacity may be required and will be provided by private sector • technical limitations for some materials become more significant	Third highest due to: • collects wider range of dry materials • designed to divert virtually all of the major waste materials except wet organics • increased processing capacity may be required and will be provided by private sector • technical limitations for some materials become more significant	Second highest due to: • ability to divert most dry and wet materials • designed to divert virtually all of the major waste materials including wet organics • increased processing capacity may be required for both wet and dry wastes, and will be provided by private sector	Highest due to: • ability to divert wider range of wet and dry wastes • designed to recover virtually all recyclables • increased processing capacity may be required for wet, dry and specialized (eg C&D) wastes • markets will govern materials recovered in processing and effective diversion • some technical limitations on processing some materials, particularly plastics
Performance • diversion	Lowest due to: • limited waste diversion of 25-32% (estimate approximate only, no firm data available)	Second lowest due to: • limited waste diversion potential of 34%, 38% or 46% (low, medium and high estimates of number of organizations subject to regulations) respectively	Third lowest due to: • estimated waste diversion potential of 53-58%	Third highest due to: • estimated waste diversion potential of 61-67%	Second highest due to: • estimated waste diversion potential of 68-73%	Highest due to: • estimated waste diversion potential of up to 75-80%

Social Acceptability • participation • behaviour • willingness to pay	Second lowest: • potential for least participation • small business operators not significantly affected by regulations in systems 1 and 2 • public and private operators appear willing to pay	Third highest: • potential for second least participation • small business operators not significantly affected by regulations in systems 1 and 2 • potential for IC&I willingness to pay; some major IC&I establishments now implement regulations	Highest • potential for greater participation than systems 1 and 2 but less than systems 5 and 6 • many small operators will be required to comply; smallest operators not required to participate • aggressive market development improves IC&I sector attitudes to systems 3, 4, 5 and 6 • greater enforcement required than systems 1 and 2 • cost of compliance greater than systems 1 and 2	Second highest: • potential for greater participation than systems 1 and 2 but less than 5 and 6 • many small operators affected; smallest operators not required to participate • additional burden on many operators due to expanded sorting requirements (magnitude uncertain) • aggressive market development improves IC&I sector attitudes to systems 3, 4, 5 and 6 • greater enforcement required than systems 1 and 2 • cost of compliance likely greater than systems 1, 2 and 3	Second lowest: • potential for greater participation than systems 1, 2, 3 and 4 but less than system 6 • aggressive market development improves IC&I sector attitudes to systems 3, 4, 5 and 6 • second greatest negative attitude to system 5, particularly for small and independent private sector • cost of compliance higher for more small to medium size public and independent private operators than system 3 with more effects on grocery and restaurant sector; health and customer issues with restaurants due to storage and sorting food waste • all but smallest operators required to participate • potential for proportion of non-compliance to be higher with less voluntary compliance than systems 1, 2, 3 and 4	Lowest: • potential for greatest participation as greatest proportion of IC&I sector is required to participate • aggressive market development improves IC&I sector attitudes to systems 3, 4, 5 and 6 • system 6 is the most costly to implement with the most significant cost of compliance on small to medium size public and independent private operators • greatest level of enforcement required • potential for non-compliance proportion highest with no additional voluntary compliance

Reliability
Since the variety of technologies within System 1 have been proven (specifically for the GTA), it is ranked highest with respect to reliability. System 2 (Existing and Existing/Committed), was ranked highest, since it relies on the same variety of systems, and existing facilities are likely to handle the increase in diverted materials.

Systems 3, 4 and 5 (Extended 3Rs, Expanded 3Rs and Expanded 3Rs with Organics respectively) were ranked lowest in descending order. System 3 (Extended 3Rs) relies on the same variety of technologies as System 2 (Existing/Committed) but the amount of materials handled will be significantly greater. Also, the effect of extensive 3Rs regulations is not proven in any other jurisdiction at this time. System 4 (Expanded 3Rs) is also based on proven technology, but the scale is increased over Systems 2 and 3. Source separation and processing of some materials (such as some plastics), is not proven on a large scale. System 5 (Expanded 3Rs with Organics) is ranked second lowest since it builds on Systems 3 and 4 and also requires technology to handle and process organics. The technology for processing organics is proven in North America but there are some on-going operational problems, generally related to odours and finished compost quality and markets.

System 6 (No Unprocessed Waste to Landfill) was ranked lowest because it requires the variety of technologies required in Systems 3, 4 and 5 (at a somewhat larger scale) but also additional technologies to process the more varied waste stream involved (e.g. facilities handling and processing mixed dry IC&I wastes).

Flexibility
System flexibility was judged according to the types and quantities of waste accommodated. This criterion incorporates the ability of the system to adapt to changing waste characteristics and quantities. Whether the system would help GTA achieve Ontario targets for 50% waste diversion was also taken into account.

System 1 (Existing) was ranked lowest. System 6 (No Unprocessed Waste to Landfill) was ranked highest, as it handles the full range of IC&I waste materials generated within GTA. System 6 therefore potentially handles the greatest amount and the greatest range of material. Systems 2 through 5 were ranked in ascending order. The systems handle an increasing range and/or quantity of materials progressing from 1 through 6. Systems 1 to 4 concentrate on an increasing variety of dry materials. System 5 is ranked higher than Systems 1-4 because it processes and diverts both dry and wet streams.

Performance
System 6 was ranked highest for performance because it is estimated to divert the greatest quantity of material from disposal. System 1 was ranked lowest as it diverts the least material from disposal.

Systems 2 through 5 successively increase the amount of material diverted, and are ranked higher in ascending order.

Social Acceptability
System 3 was identified highest in terms of Social Acceptability because it is expected to achieve the greatest level of participation and compliance. The more significant generators of waste materials will be targeted by regulations, while the smallest firms and smallest generators will be relieved of the burden.

System 4 was ranked lower than System 3 as it increases the list of materials required to be source separated for many smaller generators of those materials. While participation is expected to remain high in System 4, willingness and compliance may decrease among some establishments.

System 2 was ranked third highest. Only the largest establishments will be subject to the 3Rs regulations as currently proposed, so that participation would be lower than under Systems 3 and 4, while compliance may be higher. System 1, based on voluntary participation only, would achieve a lower overall participation rate in waste diversion activities.

System 5 was ranked lower than Systems 3 and 4 since the burden is likely to be greater on smaller establishments in the food/beverage manufacturing and retail sectors and in the accommodation sector. This may adversely affect attitudes and compliance with regulations. Similarly, System 6, which places a burden, if not of substantial source separation, at least of cost, on all waste generators. Thus it is ranked lowest of systems with respect to social acceptability.

OVERALL SYSTEM RANKING

The IC&I system ranking under the service criteria grouping was:

Highest	System 3 - Extended 3Rs Regulations
Second highest	System 4 - Expanded 3Rs Regulations
Third highest	System 2 - Existing/Committed
Third lowest	System 5 - Expanded 3Rs Regulations with Organics
Second lowest	System 1 - Existing
Lowest	System 6 - No Unprocessed Waste to Landfill

Overall, systems 3 and 4 (Extended 3Rs and Expanded 3Rs) were ranked highest, using the ranking system discussed above. System 3 ranked highest for social acceptability and second highest for reliability and so, was ranked highest overall. Its performance was ranked third highest, but was greater than 50% diversion, and was therefore considered acceptable. System 4 ranked second highest for social acceptability, while it ranked better than System 3 in terms of performance and flexibility because it diverted a greater range and quantity of materials from a wider selection of industrial sectors. Therefore, on balance it was considered second highest overall.

Systems 2 was ranked third highest. It was considered the most reliable, but it compared less favourably to Systems 3 and 4 in terms of performance, social acceptability and flexibility. It ranked higher than System 2 for flexibility and performance, and therefore on balance was also ranked highest, and was ranked third highest overall.

Systems 6 and 1 (No Unprocessed Waste to Landfill and Existing respectively) were ranked lowest, for different reasons. The performance of System 6 was considered best, but it was ranked lowest with respect to reliability and social acceptability. System 1 (Existing) was ranked most reliable, but in terms of performance it was ranked lowest and second lowest for social acceptability. It was considered less flexible than System 6, but because social acceptability is considered a more important criterion, System 1 is ranked higher than System 6. Therefore, System 6 is ranked lowest, and System 1 is ranked second lowest.

System 5 (Expanded 3Rs with Organics) was ranked third lowest. Its performance was second highest but it was ranked lower than Systems 2, 3 and 4 in terms of reliability and social acceptability. It was ranked higher than System 1 for flexibility and equal to System 1 for social acceptability, therefore, overall it ranked higher than System 1.

7.5 Summary of Findings

Results of the Net Effects Analysis process show considerable consistency among the regions with respect to the highest and lowest ranked systems for diversion of residential waste in the Service discipline. For each of Durham, Metro, York and Peel, the Expanded Blue Box was ranked highest with respect to Service. For each region, Systems 6A and 6B - Mixed Waste Processing (low and high quality finished product) were ranked lowest. For Durham Region, System 1 (Existing) and System 2 (Existing/Committed) were also ranked lowest.

For the GTA, IC&I System 3 (Extended 3Rs - 90% cut off) was ranked highest overall in terms of Service. The lowest ranked system was System 6 , No Unprocessed Waste to Landfill.

8.0 REGIONAL WASTE DIVERSION PROJECTIONS

8.1 Introduction

This chapter presents residential and IC&I waste generation, reduction and diversion estimates for the Regions of Durham, Metro Toronto, York and Peel for the years 1996 to 2015. These estimates have been carried out for six residential and six IC&I systems for each Region. There are a number of possible combinations of residential and IC&I systems which could be considered, and the diversion achieved in each Region will depend on which residential and IC&I system combination is implemented. The range of potential diversion achieved has been estimated by combining each of five residential systems (the Existing/Committed plus four others) with each of five IC&I systems (the Existing/Committed plus four others). The Existing residential and IC&I systems were not included in this assessment, as the Existing/Committed systems will be in place by 1996.

The approach to these estimates is presented below, and the results are provided in a series of tables included in this chapter.

8.2 Residential Waste Diverted and Disposed

Estimates of residential waste diverted include residential waste reduced and residential waste reused/recycled.

A conservative source reduction estimate increasing from 0% in 1992 to 5% by the year 2000, and increasing in increments of 0.5% per year from the year 2000 to 2015 was applied to the residential waste generation estimates developed in Chapter 3 of this document. The 5% source reduction value was considered reasonable based on the likely impacts of NAPP on packaging waste, and some increases in reuse activities. This value compares to objectives set or met in other jurisdictions in North America (see Schedule B on source reduction). The increment of 0.5% per year from the year 2000 to 2015 is considered a modest, but reasonable allowance to account for behaviour change which may occur as a result of increased awareness of waste reduction issues over time.

The residential waste diversion estimates developed for each region, for each residential diversion system (presented in detail in Chapter 4) are presented in Tables 8.1 to 8.4 for the Regions of Durham, Metro Toronto, and York and Peel. These were combined with source reduction estimates (described above) and residential waste generation estimates (presented in detail in Chapter 3) to estimate waste diversion achieved by each system, each year from 1996 to 2015.

Table 8.1
Estimated Residential Waste Generation, Diversion and Disposal Requirements
For Six Residential Systems

Region of Durham

Year	Population (1)	Residential Waste Generated (tonnes) (2)	Source Reduction (%)	Source Reduction (tonnes)	Existing System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Ex/Com System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Direct Cost System Diversion (tonnes) (low)	Direct Cost System Diversion (tonnes) (high)	Waste Requiring Disposal (tonnes) (low)	Waste Requiring Disposal (tonnes) (high)
Residential System Diversion (%)					27%		28%		43%	48%		
1996	484,745	159,966	2.5%	3,999	43,563	112,404	44,647	111,320	69,027	77,583	86,939	78,383
1997	500,120	165,040	3.1%	5,157	44,945	114,938	46,063	113,819	71,217	80,044	88,666	79,838
1998	515,450	170,099	3.8%	6,379	46,322	117,398	47,475	116,245	73,400	82,498	90,320	81,222
1999	530,750	175,148	4.4%	7,663	47,697	119,788	48,884	118,601	75,578	84,946	91,907	82,538
2000	546,005	180,182	5.0%	9,009	49,068	122,104	50,289	120,883	77,751	87,388	93,422	83,785
2001	561,230	185,206	5.5%	10,186	50,436	124,583	51,691	123,328	79,919	89,825	95,101	85,195
2002	576,425	190,220	6.0%	11,413	51,802	127,005	53,091	125,716	82,082	92,257	96,725	86,550
2003	592,125	195,401	6.5%	12,701	53,213	129,487	54,537	128,163	84,318	94,769	98,382	87,931
2004	607,790	200,571	7.0%	14,040	54,621	131,910	55,980	130,551	86,549	97,277	99,982	89,254
2005	623,420	205,729	7.5%	15,430	56,025	134,274	57,419	132,880	88,774	99,778	101,525	90,521
2006	639,025	210,878	8.0%	16,870	57,428	136,580	58,857	135,151	90,997	102,276	103,011	91,732
2007	654,600	216,018	8.5%	18,362	58,827	138,829	60,291	137,365	93,214	104,769	104,442	92,888
2008	670,160	221,153	9.0%	19,904	60,226	141,023	61,724	139,525	95,430	107,259	105,819	93,990
2009	685,690	226,278	9.5%	21,496	61,621	143,160	63,155	141,627	97,642	109,745	107,140	95,037
2010	701,740	231,574	10.0%	23,157	63,064	145,353	64,633	143,784	99,927	112,313	108,490	96,103
2011	717,780	236,867	10.5%	24,871	64,505	147,491	66,110	145,886	102,211	114,881	109,785	97,116
2012	733,770	242,144	11.0%	26,636	65,942	149,566	67,583	147,925	104,488	117,440	111,020	98,068
2013	749,695	247,399	11.5%	28,451	67,373	151,575	69,050	149,899	106,756	119,989	112,193	98,960
2014	765,465	252,603	12.0%	30,312	68,791	153,500	70,502	151,789	109,001	122,513	113,290	99,779
2015	781,045	257,745	12.5%	32,218	70,191	155,336	71,937	153,590	111,220	125,006	114,307	100,521
Total		**4,170,220**		**338,255**	**1,135,660**	**2,696,305**	**1,163,919**	**2,668,046**	**1,799,501**	**2,022,554**	**2,032,464**	**1,809,411**

Notes:

(1) Population data from Hardy Stevenson and Associates, 1993.

(2) Population projection multiplied by 0.33 tonnes/capita/year (based on historical data)

Table 8.1 (cont'd)
Estimated Residential Waste Generation, Diversion and Disposal Requirements
For Six Residential Systems

Region of Durham

Year	Expanded Blue Box System Diversion (tonnes)		Waste Requiring Disposal (tonnes)		Wet/Dry System Diversion (tonnes)		Waste Requiring Disposal (tonnes)		Mixed Waste Proc. System Diversion (tonnes)		Waste Requiring Disposal (tonnes)	
	(low)	(high)	(low)	(high)	(low)	(high)	(low)	(high)	(low)	(high)	(low)	(high)
	48%	56%			61%	64%			60%	79%		
1996	76,668	89,063	79,299	66,904	98,184	102,364	57,783	53,602	95,432	125,635	60,535	30,332
1997	79,100	91,888	80,782	67,994	101,298	105,611	58,584	54,271	98,459	129,619	61,423	30,263
1998	81,524	94,704	82,195	69,015	104,403	108,848	59,317	54,872	101,477	133,593	62,243	30,127
1999	83,944	97,515	83,540	69,969	107,502	112,079	59,983	55,406	104,489	137,558	62,996	29,927
2000	86,357	100,318	84,815	70,854	110,592	115,301	60,581	55,872	107,492	141,512	63,680	29,661
2001	88,765	103,116	86,254	71,904	113,675	118,516	61,344	56,504	110,490	145,458	64,530	29,562
2002	91,168	105,907	87,639	72,900	116,753	121,724	62,054	57,083	113,481	149,396	65,326	29,411
2003	93,652	108,792	89,049	73,908	119,933	125,040	62,767	57,660	116,572	153,465	66,128	29,235
2004	96,129	111,670	90,402	74,861	123,106	128,348	63,425	58,183	119,656	157,525	66,875	29,006
2005	98,601	114,542	91,698	75,757	126,272	131,648	64,027	58,651	122,733	161,576	67,566	28,723
2006	101,069	117,409	92,939	76,599	129,432	134,944	64,576	59,064	125,805	165,620	68,203	28,388
2007	103,533	120,271	94,124	77,386	132,587	138,233	65,069	59,424	128,872	169,657	68,785	27,999
2008	105,994	123,129	95,255	78,120	135,739	141,519	65,510	59,731	131,935	173,690	69,314	27,559
2009	108,450	125,983	96,331	78,799	138,884	144,798	65,897	59,983	134,992	177,715	69,789	27,066
2010	110,988	128,932	97,428	79,485	142,135	148,187	66,282	60,229	138,152	181,875	70,265	26,542
2011	113,525	131,879	98,471	80,118	145,384	151,575	66,612	60,422	141,310	186,032	70,687	25,965
2012	116,054	134,817	99,454	80,692	148,623	154,951	66,886	60,557	144,458	190,176	71,050	25,332
2013	118,573	137,742	100,375	81,206	151,848	158,314	67,100	60,634	147,593	194,303	71,356	24,645
2014	121,067	140,640	101,224	81,651	155,042	161,644	67,249	60,647	150,698	198,391	71,593	23,900
2015	123,531	143,502	101,995	82,024	158,198	164,934	67,329	60,592	153,765	202,429	71,762	23,098
Total	1,998,695	2,321,819	1,833,270	1,510,146	2,559,589	2,668,578	1,272,376	1,163,387	2,487,860	3,275,223	1,344,105	556,742

Table 8.2
Estimated Residential Waste Generation, Diversion and Disposal Requirements
For Six Residential Systems

Metro Toronto

Year	Population (1)	Residential Waste Generated (tonnes) (2)	Source Reduction (%)	Source Reduction (tonnes)	Existing System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Ex/Com System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Direct Cost System Diversion (tonnes) (low)	Direct Cost System Diversion (tonnes) (high)	Waste Requiring Disposal (tonnes) (low)	Waste Requiring Disposal (tonnes) (high)
Residential System Diversion (%)					19%		21%		33%	42%		
1996	2,389,150	1,146,792	2.5%	28,670	222,101	896,021	245,221	872,901	380,338	482,943	737,784	635,180
1997	2,404,140	1,153,987	3.1%	36,062	223,495	894,430	246,760	871,165	382,724	485,973	735,201	631,952
1998	2,419,130	1,161,182	3.8%	43,544	224,888	892,750	248,299	869,340	385,111	489,003	732,527	628,635
1999	2,434,120	1,168,378	4.4%	51,117	226,282	890,979	249,837	867,424	387,497	492,033	729,764	625,228
2000	2,449,110	1,175,573	5.0%	58,779	227,675	889,119	251,376	865,418	389,883	495,063	726,911	621,731
2001	2,464,100	1,182,768	5.5%	65,052	229,069	888,647	252,914	864,802	392,270	498,093	725,446	619,623
2002	2,470,430	1,185,806	6.0%	71,148	229,657	885,001	253,564	861,094	393,277	499,373	721,381	615,285
2003	2,476,760	1,188,845	6.5%	77,275	230,246	881,324	254,214	857,356	394,285	500,652	717,285	610,918
2004	2,483,090	1,191,883	7.0%	83,432	230,834	877,617	254,863	853,588	395,293	501,932	713,159	606,520
2005	2,489,420	1,194,922	7.5%	89,619	231,423	873,880	255,513	849,789	396,300	503,211	709,002	602,091
2006	2,495,750	1,197,960	8.0%	95,837	232,011	870,112	256,163	845,960	397,308	504,491	704,815	597,632
2007	2,502,080	1,200,998	8.5%	102,085	232,600	866,314	256,812	842,101	398,316	505,770	700,598	593,143
2008	2,508,410	1,204,037	9.0%	108,363	233,188	862,485	257,462	838,211	399,323	507,050	696,350	588,624
2009	2,514,740	1,207,075	9.5%	114,672	233,776	858,627	258,112	834,291	400,331	508,329	692,072	584,074
2010	2,521,070	1,210,114	10.0%	121,011	234,365	854,737	258,762	830,341	401,339	509,609	687,763	579,493
2011	2,527,400	1,213,152	10.5%	127,381	234,953	850,818	259,411	826,360	402,347	510,889	683,424	574,883
2012	2,532,890	1,215,787	11.0%	133,737	235,464	846,587	259,975	822,076	403,221	511,998	678,830	570,052
2013	2,538,380	1,218,422	11.5%	140,119	235,974	842,330	260,538	817,766	404,095	513,108	674,209	565,196
2014	2,543,870	1,221,058	12.0%	146,527	236,484	838,046	261,102	813,429	404,968	514,218	669,562	560,313
2015	2,549,360	1,223,693	12.5%	152,962	236,995	833,736	261,665	809,066	405,842	515,328	664,889	555,404
Total		**23,862,432**		**1,847,391**	**4,621,481**	**17,393,560**	**5,102,564**	**16,912,477**	**7,914,068**	**10,049,064**	**14,100,973**	**11,965,977**

Notes:

(1) Population data from Hardy Stevenson and Associates, 1993.

(2) Population projection multiplied by 0.48 tonnes/capita/year (based on historical data)

Table 8.2 (cont'd)
Estimated Residential Waste Generation, Diversion and Disposal Requirements
For Six Residential Systems

Metro Toronto

Year	Expanded Blue Box System Diversion (tonnes)		Waste Requiring Disposal (tonnes)		Wet/Dry System Diversion (tonnes)		Waste Requiring Disposal (tonnes)		Mixed Waste Proc. System Diversion (tonnes)		Waste Requiring Disposal (tonnes)	
	(low)	(high)	(low)	(high)	(low)	(high)	(low)	(high)	(low)	(high)	(low)	(high)
	37%	48%			49%	62%			54%	74%		
1996	426,498	551,380	691,624	566,742	558,422	707,772	559,700	410,351	616,420	847,801	501,702	270,321
1997	429,174	554,840	688,751	563,086	561,926	712,212	555,999	405,713	620,288	853,120	497,637	264,805
1998	431,850	558,299	685,788	559,339	565,430	716,653	552,208	400,985	624,156	858,440	493,482	259,198
1999	434,526	561,759	682,735	555,503	568,933	721,094	548,328	396,167	628,023	863,759	489,238	253,502
2000	437,202	565,218	679,592	551,576	572,437	725,534	544,357	391,260	631,891	869,078	484,903	247,716
2001	439,878	568,677	677,838	549,038	575,941	729,975	541,775	387,741	635,758	874,398	481,958	243,318
2002	441,008	570,138	673,650	544,520	577,420	731,850	537,238	382,808	637,391	876,644	477,267	238,014
2003	442,138	571,599	669,432	539,971	578,900	733,726	532,670	377,844	639,025	878,890	472,545	232,680
2004	443,268	573,060	665,183	535,391	580,379	735,601	528,072	372,851	640,658	881,136	467,794	227,315
2005	444,398	574,521	660,905	530,782	581,859	737,476	523,444	367,827	642,291	883,382	463,011	221,920
2006	445,528	575,982	656,595	526,141	583,338	739,351	518,785	362,772	643,924	885,629	458,199	216,495
2007	446,658	577,443	652,256	521,471	584,818	741,226	514,096	357,687	645,557	887,875	453,356	211,039
2008	447,788	578,904	647,886	516,770	586,297	743,102	509,376	352,572	647,191	890,121	448,483	205,552
2009	448,918	580,364	643,485	512,039	587,777	744,977	504,626	347,426	648,824	892,367	443,579	200,036
2010	450,048	581,825	639,054	507,277	589,257	746,852	499,846	342,250	650,457	894,614	438,645	194,489
2011	451,178	583,286	634,593	502,485	590,736	748,727	495,035	337,044	652,090	896,860	433,681	188,911
2012	452,158	584,553	629,893	497,497	592,019	750,354	490,031	331,697	653,507	898,808	428,544	183,243
2013	453,138	585,820	625,166	492,484	593,302	751,980	485,001	326,324	654,923	900,756	423,381	177,548
2014	454,118	587,087	620,413	487,443	594,586	753,606	479,945	320,924	656,340	902,704	418,191	171,826
2015	455,098	588,354	615,633	482,377	595,869	755,233	474,862	315,498	657,756	904,652	412,975	166,079
Total	8,874,571	11,473,110	13,140,470	10,541,931	11,619,648	14,727,301	10,395,393	7,287,740	12,826,469	17,641,035	9,188,572	4,374,006

Table 8.3
Estimated Residential Waste Generation, Diversion and Disposal Requirements
For Six Residential Systems

Region of York

Year	Population (1)	Residential Waste Generated (tonnes) (2)	Source Reduction (%)	Source Reduction (tonnes)	Existing System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Ex/Com System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Direct Cost System Diversion (tonnes) (low)	(high)	Waste Requiring Disposal (tonnes) (low)	(high)
Residential System Diversion (%)					28%		28%		44%	50%		
1996	597,459	221,060	2.5%	5,526	62,605	152,928	62,605	152,928	97,254	110,797	118,279	104,736
1997	615,017	227,556	3.1%	7,111	64,445	156,000	64,445	156,000	100,112	114,053	120,333	106,392
1998	632,605	234,064	3.8%	8,777	66,288	158,999	66,288	158,999	102,975	117,315	122,311	107,972
1999	650,193	240,571	4.4%	10,525	68,131	161,916	68,131	161,916	105,838	120,577	124,208	109,470
2000	667,781	247,079	5.0%	12,354	69,974	164,751	69,974	164,751	108,701	123,838	126,024	110,887
2001	685,370	253,587	5.5%	13,947	71,817	167,823	71,817	167,823	111,564	127,100	128,075	112,540
2002	701,325	259,490	6.0%	15,569	73,489	170,432	73,489	170,432	114,162	130,059	129,759	113,862
2003	717,280	265,394	6.5%	17,251	75,160	172,983	75,160	172,983	116,759	133,018	131,384	115,125
2004	733,235	271,297	7.0%	18,991	76,832	175,474	76,832	175,474	119,356	135,976	132,950	116,330
2005	749,190	277,200	7.5%	20,790	78,504	177,906	78,504	177,906	121,953	138,935	134,457	117,475
2006	765,143	283,103	8.0%	22,648	80,176	180,279	80,176	180,279	124,550	141,894	135,905	118,561
2007	780,277	288,702	8.5%	24,540	81,762	182,401	81,762	182,401	127,013	144,700	137,149	119,463
2008	795,411	294,302	9.0%	26,487	83,347	184,467	83,347	184,467	129,477	147,507	138,338	120,308
2009	810,545	299,902	9.5%	28,491	84,933	186,478	84,933	186,478	131,940	150,313	139,471	121,098
2010	825,679	305,501	10.0%	30,550	86,519	188,432	86,519	188,432	134,404	153,120	140,547	121,831
2011	840,019	310,807	10.5%	32,635	88,022	190,151	88,022	190,151	136,738	155,779	141,434	122,393
2012	853,042	315,626	11.0%	34,719	89,386	191,520	89,386	191,520	138,858	158,194	142,049	122,712
2013	865,270	320,150	11.5%	36,817	90,668	192,665	90,668	192,665	140,849	160,462	142,484	122,871
2014	877,498	324,674	12.0%	38,961	91,949	193,764	91,949	193,764	142,839	162,730	142,874	122,984
2015	889,726	329,199	12.5%	41,150	93,230	194,818	93,230	194,818	144,830	164,997	143,219	123,051
Total		**5,569,264**		**447,839**	**1,577,237**	**3,544,188**	**1,577,237**	**3,544,188**	**2,450,174**	**2,791,365**	**2,671,250**	**2,330,060**

Notes:

(1) Population data from Hardy Stevenson and Associates, 1993.

(2) Population projection multiplied by 0.37 tonnes/capita/year (based on historical data)

Table 8.3 (cont'd)
Estimated Residential Waste Generation, Diversion and Disposal Requirements
For Six Residential Systems

Region of York

Year	Expanded Blue Box System Diversion (tonnes)		Waste Requiring Disposal (tonnes)		Wet/Dry System Diversion (tonnes)		Waste Requiring Disposal (tonnes)		Mixed Waste Proc. System Diversion (tonnes)		Waste Requiring Disposal (tonnes)	
	(low)	(high)	(low)	(high)	(low)	(high)	(low)	(high)	(low)	(high)	(low)	(high)
	49%	56%			61%	65%			60%	79%		
1996	107,220	124,094	108,313	91,439	134,354	144,075	81,179	71,458	132,773	174,200	82,760	41,334
1997	110,371	127,741	110,074	92,704	138,303	148,309	82,143	72,136	136,675	179,319	83,770	41,126
1998	113,528	131,394	111,759	93,893	142,258	152,550	83,029	72,736	140,584	184,447	84,703	40,839
1999	116,684	135,047	113,363	95,000	146,213	156,791	83,834	73,255	144,492	189,575	85,554	40,471
2000	119,840	138,700	114,885	96,025	150,168	161,033	84,557	73,692	148,401	194,703	86,324	40,022
2001	122,997	142,353	116,643	97,286	154,123	165,274	85,516	74,365	152,310	199,832	87,330	39,808
2002	125,860	145,667	118,061	98,254	157,711	169,122	86,210	74,799	155,855	204,484	88,065	39,437
2003	128,723	148,981	119,420	99,162	161,299	172,969	86,844	75,174	159,401	209,136	88,742	39,007
2004	131,587	152,295	120,720	100,011	164,887	176,817	87,419	75,489	162,947	213,788	89,359	38,518
2005	134,450	155,609	121,960	100,801	168,475	180,664	87,935	75,746	166,492	218,440	89,918	37,971
2006	137,313	158,922	123,142	101,532	172,062	184,511	88,392	75,943	170,038	223,091	90,417	37,364
2007	140,029	162,066	124,134	102,097	175,466	188,161	88,697	76,002	173,401	227,504	90,762	36,659
2008	142,745	165,209	125,070	102,606	178,869	191,810	88,946	76,005	176,764	231,916	91,051	35,899
2009	145,461	168,352	125,950	103,059	182,272	195,460	89,139	75,951	180,127	236,329	91,284	35,082
2010	148,177	171,496	126,774	103,455	185,675	199,109	89,276	75,842	183,491	240,741	91,460	34,210
2011	150,750	174,474	127,422	103,698	188,900	202,567	89,272	75,605	186,677	244,922	91,495	33,250
2012	153,087	177,179	127,819	103,728	191,829	205,708	89,078	75,199	189,571	248,720	91,335	32,187
2013	155,282	179,719	128,051	103,614	194,579	208,656	88,754	74,676	192,289	252,285	91,044	31,048
2014	157,476	182,259	128,237	103,455	197,328	211,605	88,385	74,108	195,006	255,850	90,707	29,863
2015	159,671	184,798	128,378	103,250	200,078	214,554	87,971	73,495	197,724	259,415	90,325	28,633
Total	2,701,249	3,126,355	2,420,175	1,995,070	3,384,850	3,629,747	1,736,574	1,491,678	3,345,020	4,388,698	1,776,405	732,727

Table 8.4
Estimated Residential Waste Generation, Diversion and Disposal
For Six Residential Systems

Region of Peel

Year	Population (1)	Residential Waste Generated (tonnes) (2)	Source Reduction (%)	Source Reduction (tonnes)	Existing System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Ex/Com System Diversion (tonnes)	Waste Requiring Disposal (tonnes)	Direct Cost System Diversion (tonnes) (low)	Direct Cost System Diversion (tonnes) (high)	Waste Requiring Disposal (tonnes) (low)	Waste Requiring Disposal (tonnes) (high)
Residential System Diversion (%)					20%		25%		40%	47%		
1996	859,300	352,313	2.5%	8,808	71,062	272,444	86,468	257,037	139,888	165,000	203,617	178,506
1997	879,500	360,595	3.1%	11,269	72,732	276,594	88,501	260,826	143,176	168,878	206,150	180,448
1998	900,700	369,287	3.8%	13,848	74,485	280,954	90,634	264,805	146,627	172,949	208,811	182,490
1999	921,900	377,979	4.4%	16,537	76,238	285,204	92,767	268,675	150,079	177,020	211,364	184,423
2000	953,100	390,771	5.0%	19,539	78,819	292,414	95,907	275,326	155,158	183,011	216,075	188,222
2001	974,300	399,463	5.5%	21,970	80,572	296,921	98,040	279,453	158,609	187,081	218,884	190,411
2002	991,100	406,351	6.0%	24,381	81,961	300,009	99,730	282,239	161,344	190,307	220,626	191,663
2003	1,007,900	413,239	6.5%	26,861	83,350	303,028	101,421	284,957	164,079	193,533	222,300	192,845
2004	1,024,700	420,127	7.0%	29,409	84,740	305,978	103,112	287,607	166,814	196,759	223,904	193,959
2005	1,041,500	427,015	7.5%	32,026	86,129	308,860	104,802	290,187	169,549	199,985	225,440	195,004
2006	1,058,100	433,821	8.0%	34,706	87,502	311,614	106,472	292,643	172,251	203,172	226,864	195,943
2007	1,072,100	439,561	8.5%	37,363	88,659	313,539	107,881	294,317	174,530	205,861	227,668	196,338
2008	1,086,100	445,301	9.0%	40,077	89,817	315,407	109,290	295,934	176,809	208,549	228,415	196,675
2009	1,100,100	451,041	9.5%	42,849	90,975	317,217	110,699	297,493	179,088	211,237	229,104	196,955
2010	1,114,100	456,781	10.0%	45,678	92,133	318,970	112,108	298,995	181,367	213,925	229,736	197,178
2011	1,127,900	462,439	10.5%	48,556	93,274	320,609	113,496	300,387	183,614	216,575	230,269	197,308
2012	1,139,500	467,195	11.0%	51,391	94,233	321,570	114,663	301,140	185,502	218,803	230,301	197,001
2013	1,150,500	471,705	11.5%	54,246	95,143	322,316	115,770	301,689	187,293	220,915	230,166	196,544
2014	1,162,000	476,420	12.0%	57,170	96,094	323,156	116,927	302,322	189,165	223,123	230,084	196,127
2015	1,173,500	481,135	12.5%	60,142	97,045	323,948	118,085	302,908	191,037	225,331	229,956	195,662
Total		**8,502,539**		**676,825**	**1,714,962**	**6,110,752**	**2,086,773**	**5,738,940**	**3,375,979**	**3,982,014**	**4,449,735**	**3,843,700**

Notes:

(1) Population data from Hardy Stevenson and Associates, 1993.

(2) Population projection multiplied by 0.41 tonnes/capita/year (based on historical data)

Table 8.4 (cont'd)
Estimated Residential Waste Generation, Diversion and Disposal
For Six Residential Systems

Region of Peel

Year	Expanded Blue Box System Diversion (tonnes)		Waste Requiring Disposal (tonnes)		Wet/Dry System Diversion (tonnes)		Waste Requiring Disposal (tonnes)		Mixed Waste Proc. System Diversion (tonnes)		Waste Requiring Disposal (tonnes)	
	(low)	(high)	(low)	(high)	(low)	(high)	(low)	(high)	(low)	(high)	(low)	(high)
	38%	48%			56%	65%			56%	77%		
1996	135,607	168,498	207,898	175,007	195,912	228,198	147,594	115,307	196,295	272,448	147,210	71,057
1997	138,795	172,459	210,532	176,868	200,517	233,563	148,809	115,764	200,910	278,852	148,417	70,474
1998	142,140	176,616	213,298	178,823	205,350	239,193	150,088	116,246	205,753	285,574	149,686	69,865
1999	145,486	180,773	215,956	180,669	210,184	244,822	151,259	116,620	210,596	292,296	150,847	69,147
2000	150,410	186,891	220,823	184,342	217,297	253,108	153,935	118,124	217,723	302,188	153,510	69,045
2001	153,755	191,048	223,737	186,445	222,131	258,738	155,362	118,755	222,566	308,909	154,927	68,583
2002	156,407	194,342	225,563	187,628	225,961	263,199	156,009	118,771	226,403	314,236	155,567	67,734
2003	159,058	197,636	227,321	188,742	229,791	267,661	156,587	118,718	230,241	319,563	156,137	66,816
2004	161,709	200,931	229,009	189,787	233,621	272,122	157,097	118,596	234,079	324,889	156,639	65,829
2005	164,360	204,225	230,629	190,764	237,451	276,584	157,537	118,405	237,916	330,216	157,072	64,773
2006	166,980	207,480	232,135	191,635	241,236	280,992	157,879	118,123	241,709	335,479	157,407	63,636
2007	169,189	210,225	233,009	191,973	244,428	284,710	157,770	117,488	244,907	339,918	157,292	62,281
2008	171,399	212,970	233,825	192,253	247,620	288,428	157,604	116,796	248,105	344,356	157,119	60,867
2009	173,608	215,716	234,584	192,476	250,812	292,146	157,380	116,046	251,303	348,795	156,889	59,397
2010	175,817	218,461	235,286	192,642	254,003	295,864	157,099	115,239	254,501	353,234	156,602	57,869
2011	177,995	221,167	235,888	192,716	257,150	299,528	156,733	114,354	257,653	357,609	156,230	56,273
2012	179,826	223,442	235,978	192,362	259,794	302,609	156,009	113,195	260,303	361,287	155,500	54,516
2013	181,562	225,599	235,897	191,860	262,302	305,530	155,157	111,929	262,816	364,775	154,643	52,684
2014	183,376	227,854	235,873	191,396	264,924	308,584	154,325	110,665	265,443	368,421	153,807	50,828
2015	185,191	230,109	235,802	190,885	267,546	311,638	153,447	109,355	268,070	372,067	152,923	48,926
Total	3,272,669	4,066,440	4,553,044	3,759,274	4,728,031	5,507,218	3,097,683	2,318,496	4,737,291	6,575,113	3,088,423	1,250,601

8.3 IC&I Waste Diverted and Disposed

Projections of quantities of IC&I waste generated from the year 1996 to the year 2015 are presented in Table 5.4 of Chapter 5 of this document for each GTA region and for the entire GTA. A source reduction allowance was applied to these estimates to identify the potential quantities of waste which will not be generated by the IC&I sector due to three factors, which were:

- changes in economic activity and the employment profile of each region;
- innovation leading to reduced IC&I waste generation (assumed to increase by an increment of 0.5% from 1993 to 2015);
- improved waste management practices in the C&D sector (assumed to increase by an increment of 0.25% per year from 1993 to 2015).

The methods used to estimate source reduction as a result of these three factors are described below.

Source Reduction due to Changes in the Employment Profile of each GTA Region: Future employment in each major IC&I sector in each Region was compared to current employment to determine if there was a major shift towards IC&I groups which have traditionally been lower waste generators. The IC&I per employee generation rates presented in Table 5.6 in chapter 5 of this document were used to adjust future IC&I waste generation estimates. This was carried out by assuming that regional IC&I waste generation would continue at the rates experienced around 1987. Changes in generation as a result of employment shifts to different industries are shown as "Estimated Reduction in IC&I waste due to change in Employment Profile (tonnes)" in Tables 8.5 to 8.8.

Source Reduction due to Innovation: The IC&I sector (excluding the construction and demolition sector which is addressed separately) is expected to reduce the generation of some wastes over the planning period through modernization, process change, increased operational efficiencies, etc. While it is generally accepted that this trend is occurring and will continue, because of global competition, etc., very little quantitative data are available on the impacts of this trend on future IC&I waste generation for the whole IC&I sector. Many case studies quote exceptional programs where significant reductions have been achieved (see Schedule O). However, these are high profile examples of innovative behaviour and can not be applied to the total IC&I sector for waste generation estimates. A modest source reduction allowance of 0.5% per year in waste reduction, starting in 1993, and continuing to the year 2015 (when the reduction increment would be 11.5%) was used for this analysis.

Source Reduction in the C&D Sector: Construction and demolition waste was separated from IC&I waste for this study, as its method of generation is different to other IC&I wastes. The construction and demolition industry will also

innovate, and continue to develop more efficient construction methods. An allowance of 0.25% per year, beginning in 1993, and increasing by increments of 0.25% per year from 1993 to 2015 was applied to estimate source reduction in C&D waste generation each year. On this basis, reduction of C&D waste would reach 5.25% by the year 2015.

Tables 8.5 to 8.8 present the estimated quantities of IC&I waste that will be source reduced, and therefore will not be generated in each GTA Region as a result of these three factors. These quantities were subtracted from the total estimated IC&I waste to be generated in each GTA Region to produce estimates of net waste generation by the IC&I sector to the year 2015.

Estimated diversion rates for each of the six IC&I systems considered in this study are presented in Chapter 6. For the purpose of developing estimates of IC&I waste diverted and disposed under the Existing/Committed System, calculations were based on the 40% coverage scenario explained in Chapter 6.

Tables 8.9 to 8.16 present estimates of IC&I waste diversion and waste requiring disposal in each GTA Region, (except Halton) for each IC&I scenario, for the years 1996 to 2015. .

8.4. Regional Diversion Estimates

Chapters 4 and 6 discussed diversion estimates for six residential waste diversion systems in each of the regions of Durham, Metro Toronto, York and Peel, and six IC&I systems for the GTA under the **performance** indicator of the **service criteria grouping**. The disposal requirements for each region could vary depending on which residential and IC&I systems are combined to form any regional waste diversion system. The existing residential and IC&I systems are not considered in the combinations, as both the residential and IC&I existing/committed systems will be in place by 1996. Therefore, there are five potential residential systems (Existing/Committed, direct cost, expanded Blue Box, wet-dry, and mixed waste) which could be combined with five potential IC&I systems (Existing/Committed, extended 3Rs regulations, expanded 3Rs regulations, expanded 3Rs regulations with organics, and no unprocessed waste to landfill), resulting in 25 possible combinations of residential and IC&I systems for each Region.

The cumulative tonnes of waste diverted through reduction and reuse/recycling, and the cumulative diversion (expressed as a percentage of total waste generated) achieved during the twenty year period from 1996 to 2015 was estimated for the 25 potential system combinations for each of the three service areas (Durham, Metro/York, and Peel). Where low and high diversion scenarios were estimated for different systems, the percentage diversion, and the cumulative tonnes reduced and reused/recycled were estimated for each case. Tables 8.17 to 8.21 show the results of this analysis for the regions of Durham,

Table 8.5
Estimated IC&I Waste Generation and Reduction
for Durham Region
1996-2015

Year	Estimated IC&I Waste Generation (tonnes)	Estimated IC&I Waste Generation less C&D (tonnes)	Estimated Reduction in IC&I Waste Generation due to Change in Employment Profile (tonnes)	Estimated Reduction in IC&I Waste Generation due to innovation (tonnes)	Estimated Reduction in C&D Waste generation due to innovation (tonnes)	Total Reduction in IC&I Waste Generation (tonnes)	Estimated Net IC&I Waste Generation (tonnes)
1996	224,671	177,400	1,829	3,548	473	5,850	218,821
1997	231,426	182,734	2,355	4,568	609	7,532	223,894
1998	238,384	188,228	2,912	5,647	752	9,311	229,073
1999	245,550	193,886	3,499	6,786	904	11,189	234,361
2000	252,932	199,715	4,119	7,989	1,064	13,172	239,761
2001	260,537	205,720	4,773	9,257	1,233	15,264	245,274
2002	265,682	209,783	5,706	10,489	1,397	17,593	248,089
2003	270,930	213,926	6,674	11,766	1,568	20,008	250,922
2004	276,280	218,151	7,679	13,089	1,744	22,512	253,769
2005	281,737	222,460	8,720	14,460	1,927	25,107	256,630
2006	287,301	226,853	9,800	15,880	2,116	27,795	259,506
2007	292,975	231,333	10,919	17,350	2,312	30,580	262,395
2008	298,762	235,902	12,078	18,872	2,514	33,465	265,297
2009	304,663	240,562	13,279	20,448	2,724	36,451	268,212
2010	310,680	245,313	14,523	22,078	2,942	39,542	271,138
2011	316,816	250,158	15,810	23,765	3,166	42,741	274,075
2012	319,950	252,633	16,977	25,263	3,366	45,606	274,344
2013	323,117	255,133	18,165	26,789	3,569	48,524	274,593
2014	326,313	257,657	19,376	28,342	3,776	51,494	274,819
2015	329,543	260,207	20,608	29,924	3,987	54,519	275,024
Total	5,658,251	4,467,755	199,802	316,310	42,143	558,255	5,099,996

Notes

1. IC&I waste generation rates in column 1 are based on overall unit generation rate for 1987 - 1992 (Table 5.6 in Service Technical Appendix) multiplied by projected employment.
2. Estimated C&D waste generation was based on 1990 estimates of C&D waste as a percentage of total waste presented in Table 5.7 of the Service Technical Appendix.
3. Estimate of reduction in IC&I waste generation due to change in employment profile was based on an estimated change in overall unit generation rate multiplied by the number of employees (excluding C&D sector). Aggregated data on employment for each sector in GTA (Social Environment Technical Appendix) were used to determine the change in employment and the change in overa unit generation rate for each region.
4. Reduction in IC&I waste generation due to innovation was assumed to be in increments of 0.5% per year until year 2015.
5. Reduction in C&D waste generation due mostly to better waste management was assumed to be in increments of 0.25% per year.

Table 8.6
Estimated IC&I Waste Generation and Reduction
for Metro Toronto
1996-2015

Year	Estimated IC&I Waste Generation (tonnes)	Estimated IC&I Waste Generation less C&D (tonnes)	Estimated Reduction in IC&I Waste Generation due to Change in Employment Profile (tonnes)	Estimated Reduction in IC&I Waste Generation due to innovation (tonnes)	Estimated Reduction in C&D Waste generation due to innovation (tonnes)	Total Reduction in IC&I Waste Generation (tonnes)	Estimated Net IC&I Waste Generation (tonnes)
1996	1,652,012	1,367,040	16,076	27,341	2,850	46,267	1,605,745
1997	1,666,238	1,378,812	20,269	34,470	3,593	58,332	1,607,907
1998	1,680,587	1,390,686	24,532	41,721	4,349	70,601	1,609,986
1999	1,695,060	1,402,662	28,867	49,093	5,117	83,077	1,611,983
2000	1,709,657	1,414,741	33,275	56,590	5,898	95,763	1,613,895
2001	1,724,380	1,426,924	37,756	64,212	6,693	108,661	1,615,719
2002	1,735,393	1,436,038	45,637	71,802	7,484	124,923	1,610,470
2003	1,746,478	1,445,210	53,617	79,487	8,285	141,389	1,605,089
2004	1,757,633	1,454,441	61,697	87,266	9,096	158,060	1,599,573
2005	1,768,860	1,463,731	69,879	95,143	9,917	174,938	1,593,922
2006	1,780,157	1,473,080	78,162	103,116	10,748	192,025	1,588,133
2007	1,791,527	1,482,489	86,548	111,187	11,589	209,323	1,582,204
2008	1,802,971	1,491,959	95,038	119,357	12,441	226,835	1,576,136
2009	1,814,487	1,501,488	103,633	127,626	13,302	244,562	1,569,925
2010	1,826,076	1,511,078	112,334	135,997	14,175	262,505	1,563,570
2011	1,837,740	1,520,730	121,141	144,469	15,058	280,669	1,557,071
2012	1,849,478	1,530,443	130,057	153,044	15,952	299,053	1,550,425
2013	1,861,291	1,540,218	139,082	161,723	16,856	317,661	1,543,630
2014	1,873,179	1,550,056	148,216	170,506	17,772	336,494	1,536,685
2015	1,885,144	1,559,957	157,462	179,395	18,698	355,555	1,529,589
Total	**35,458,349**	**29,341,783**	**1,563,277**	**2,013,544**	**209,871**	**3,786,691**	**31,671,657**

Notes

1. IC&I waste generation rates in column 1 are based on overall unit generation rate for 1987 - 1992 (Table 5.6 in Service Technical Appendix) multiplied by projected employment.
2. Estimated C&D waste generation was based on 1990 estimates of C&D waste as a percentage of total waste presented in Table 5.7 of the Service Technical Appendix.
3. Estimate of reduction in IC&I waste generation due to change in employment profile was based on an estimated change in overall unit generation rate multiplied by the number of employees (excluding C&D sector). Aggregated data on employment for each sector in GTA (Social Environment Technical Appendix) were used to determine the change in employment and the change in overa unit generation rate for each region.
4. Reduction in IC&I waste generation due to innovation was assumed to be in increments of 0.5% per year until year 2015
5. Reduction in C&D waste generation due mostly to better waste management was assumed to be in increments of 0.25% per year

Table 8.7
Estimated IC&I Waste Generation and Reduction
for York Region
1996-2015

Year	Estimated IC&I Waste Generation (tonnes)	Estimated IC&I Waste Generation less C&D (tonnes)	Estimated Reduction in IC&I Waste Generation due to Change in Employment Profile (tonnes)	Estimated Reduction in IC&I Waste Generation due to innovation (tonnes)	Estimated Reduction in C&D Waste generation due to innovation (tonnes)	Total Reduction in IC&I Waste Generation (tonnes)	Estimated Net IC&I Waste Generation (tonnes)
1993	429,251	316,787	564	1,584	281	2,429	426,822
1994	445,694	328,922	1,171	3,289	584	5,044	440,650
1995	462,769	341,524	1,824	5,123	909	7,856	454,913
1996	480,497	354,607	2,525	7,092	1,259	10,876	469,621
1997	498,904	368,191	3,277	9,205	1,634	14,116	484,788
1998	518,017	382,297	4,083	11,469	2,036	17,588	500,430
1999	537,862	396,942	4,946	13,893	2,466	21,305	516,557
2000	558,467	412,148	5,869	16,486	2,926	25,281	533,185
2001	579,860	427,937	6,856	19,257	3,418	29,531	550,329
2002	593,931	438,321	9,393	21,916	3,890	35,200	558,732
2003	608,343	448,957	12,050	24,693	4,383	41,126	567,217
2004	623,105	459,851	14,830	27,591	4,898	47,319	575,786
2005	638,225	471,010	17,738	30,616	5,434	53,788	584,437
2006	653,712	482,440	20,779	33,771	5,995	60,544	593,168
2007	666,065	491,556	23,831	36,867	6,544	67,241	598,823
2008	678,650	500,843	26,990	40,067	7,112	74,170	604,479
2009	691,473	510,307	30,261	43,376	7,700	81,337	610,136
2010	704,538	519,949	33,646	46,795	8,307	88,748	615,790
2011	717,849	529,773	37,148	50,328	8,934	96,410	621,440
2012	725,789	535,632	40,456	53,563	9,508	103,527	622,261
2013	733,815	541,556	43,834	56,863	10,094	110,790	623,025
2014	741,930	547,544	47,133	60,230	10,691	118,054	623,876
2015	750,135	553,600	50,499	63,664	11,301	125,464	624,671
Total	**12,701,167**	**9,373,461**	**436,143**	**667,743**	**118,529**	**1,222,414**	**11,478,752**

Notes
1 IC&I waste generation rates in column 1 are based on overall unit generation rate for 1987 - 1992 (Table 5 6 in Service Technical Appendix) multiplied by projected employment.
2 Estimated C&D waste generation was based on 1990 estimates of C&D waste as a percentage of total waste presented in Table 5.7 of the Service Technical Appendix.
3 Estimate of reduction in IC&I waste generation due to change in employment profile was based on an estimated change in overall unit generation rate multiplied by the number of employees (excluding C&D sector). Aggregated data on employment for each sector in GTA (Social Environment Technical Appendix) were used to determine the change in employment and the change in overall unit generation rate for each region.
4 Reduction in IC&I waste generation due to innovation was assumed to be in increments of 0 5% per year until year 2015
5 Reduction in C&D waste generation due mostly to better waste management was assumed to be in increments of 0 25% per year.

Table 8.8
Estimated IC&I Waste Generation and Reduction
for Peel Region
1996-2015

Year	Estimated IC&I Waste Generation (tonnes)	Estimated IC&I Waste Generation less C&D (tonnes)	Estimated Reduction in IC&I Waste Generation due to Change in Employment Profile (tonnes)	Estimated Reduction in IC&I Waste Generation due to innovation (tonnes)	Estimated Reduction in C&D Waste generation due to innnvation (tonnes)	Total Reduction in IC&I Waste Generation (tonnes)	Estimated Net IC&I Waste Generation (tonnes)
1993	581,951	428,898	811	2,144	383	3,338	578,613
1994	597,747	440,539	1,665	4,405	786	6,857	590,890
1995	613,973	452,498	2,566	6,787	1,211	10,564	603,409
1996	630,637	464,779	3,514	9,296	1,659	14,468	616,169
1997	647,755	477,395	4,511	11,935	2,129	18,576	629,179
1998	665,337	490,354	5,561	14,711	2,625	22,896	642,441
1999	683,397	503,664	6,663	17,628	3,145	27,437	655,960
2000	714,547	526,621	7,963	21,065	3,759	32,786	681,762
2001	721,000	531,377	9,033	23,912	4,267	37,212	683,788
2002	731,240	538,924	11,096	26,946	4,808	42,851	688,389
2003	741,626	546,579	13,222	30,062	5,364	48,647	692,979
2004	752,158	554,341	15,394	33,260	5,935	54,589	697,569
2005	762,842	562,214	17,631	36,544	6,520	60,695	702,146
2006	773,676	570,200	19,928	39,914	7,122	66,964	706,712
2007	784,664	578,297	22,288	43,372	7,739	73,399	711,265
2008	795,809	586,511	24,710	46,921	8,372	80,003	715,806
2009	807,111	594,841	27,196	50,561	9,021	86,779	720,332
2010	818,574	603,289	29,748	54,296	9,688	93,732	724,842
2011	830,200	611,857	32,367	58,126	10,371	100,865	729,335
2012	841,991	620,547	35,055	62,055	11,072	108,182	733,809
2013	853,950	629,361	37,812	66,083	11,791	115,686	738,264
2014	866,078	638,299	40,641	70,213	12,528	123,381	742,697
2015	878,380	647,366	43,542	74,447	13,283	131,272	747,107
Total	**15,300,972**	**11,276,817**	407,875	791,347	141,197	1,340,419	13,960,553

Notes

1. IC&I waste generation rates in column 1 are based on overall unit generation rate for 1987 - 1992 (Table 5 6 in Service Technical Appendix) multiplied by projected employment
2. Estimated C&D waste generation was based on 1990 estimates of C&D waste as a percentage of total waste presented in Table 5.7 of the Service Technical Appendix
3. Estimate of reduction in IC&I waste generation due to change in employment profile was based on an estimated change in overall unit generation rate multiplied by the number of employees (excluding C&D sector) Aggregated data on employment for each sector in GTA (Social Environment Technical Appendix) were used to determine the change in employment and the change in overall unit generation rate for each region
4. Reduction in IC&I waste generation due to innovation was assumed to be in increments of 0 5% per year until year 2015
5. Reduction in C&D waste generation due mostly to better waste management was assumed to be in increments of 0 25% per year

Table 8.9
Estimated IC&I Waste Diversion
for Six IC&I Systems in Durham Region
1996-2015

Year	Estimated Net IC&I Waste Generation (1)	Estimated Diversion (tonnes)					
		Existing System	Existing/ Committed System (2) (40% capture case)	Extended 3Rs Regulations	Expanded 3Rs Regulations	Expanded 3Rs with Organics Regulations	No Unprocessed Waste to Landfill
1996	218,821	70,023	83,152	120,352	140,045	153,175	172,869
1997	223,894	71,646	85,080	123,142	143,292	156,726	176,876
1998	229,073	73,303	87,048	125,990	146,607	160,351	180,968
1999	234,361	74,996	89,057	128,899	149,991	164,053	185,145
2000	239,761	76,723	91,109	131,868	153,447	167,832	189,411
2001	245,274	78,488	93,204	134,901	156,975	171,692	193,766
2002	248,089	79,389	94,274	136,449	158,777	173,663	195,991
2003	250,922	80,295	95,350	138,007	160,590	175,645	198,228
2004	253,769	81,206	96,432	139,573	162,412	177,638	200,477
2005	256,630	82,122	97,520	141,147	164,243	179,641	202,738
2006	259,506	83,042	98,612	142,728	166,084	181,654	205,010
2007	262,395	83,966	99,710	144,317	167,933	183,676	207,292
2008	265,297	84,895	100,813	145,913	169,790	185,708	209,585
2009	268,212	85,828	101,920	147,516	171,655	187,748	211,887
2010	271,138	86,764	103,032	149,126	173,528	189,796	214,199
2011	274,075	87,704	104,148	150,741	175,408	191,852	216,519
2012	274,344	87,790	104,251	150,889	175,580	192,041	216,732
2013	274,593	87,870	104,345	151,026	175,740	192,215	216,929
2014	274,819	87,942	104,431	151,151	175,884	192,374	217,107
2015	275,024	88,008	104,509	151,263	176,015	192,517	217,269
Total	5,099,996	1,631,999	1,937,999	2,804,998	3,263,998	3,569,997	4,028,997

Table 8.10
Estimated IC&I Waste Diversion
for Six IC&I Systems in Metro Toronto
1996-2015

Year	Estimated Net IC&I Waste Generation (1)	Estimated Diversion (tonnes)					
		Existing System	Existing/ Committed System (2) (40% capture case)	Extended 3Rs Regulations	Expanded 3Rs Regulations	Expanded 3Rs with Organics Regulations	No Unprocessed Waste to Landfill
1996	1,603,254	513,041	609,236	881,789	1,026,082	1,122,277	1,266,570
1997	1,604,766	513,525	609,811	882,621	1,027,050	1,123,336	1,267,765
1998	1,606,185	513,979	610,350	883,402	1,027,958	1,124,329	1,268,886
1999	1,607,510	514,403	610,854	884,130	1,028,806	1,125,257	1,269,933
2000	1,608,738	514,796	611,321	884,806	1,029,593	1,126,117	1,270,903
2001	1,609,869	515,158	611,750	885,428	1,030,316	1,126,908	1,271,796
2002	1,603,642	513,165	609,384	882,003	1,026,331	1,122,549	1,266,877
2003	1,597,270	511,126	606,963	878,499	1,022,253	1,118,089	1,261,844
2004	1,590,752	509,041	604,486	874,914	1,018,081	1,113,526	1,256,694
2005	1,584,086	506,907	601,953	871,247	1,013,815	1,108,860	1,251,428
2006	1,577,269	504,726	599,362	867,498	1,009,452	1,104,088	1,246,043
2007	1,578,796	505,215	599,942	868,338	1,010,429	1,105,157	1,247,249
2008	1,580,279	505,689	600,506	869,153	1,011,378	1,106,195	1,248,420
2009	1,581,715	506,149	601,052	869,943	1,012,298	1,107,201	1,249,555
2010	1,583,105	506,594	601,580	870,708	1,013,187	1,108,174	1,250,653
2011	1,584,450	507,024	602,091	871,447	1,014,048	1,109,115	1,251,715
2012	1,585,746	507,439	602,584	872,160	1,014,878	1,110,022	1,252,739
2013	1,586,994	507,838	603,058	872,847	1,015,676	1,110,896	1,253,725
2014	1,588,194	508,222	603,514	873,507	1,016,444	1,111,736	1,254,673
2015	1,589,344	508,590	603,951	874,139	1,017,180	1,112,541	1,255,582
Total	**31,851,963**	**10,192,628**	**12,103,746**	**17,518,580**	**20,385,256**	**22,296,374**	**25,163,051**

(1) Refer to Table 8.5 for derivation of net IC&I waste generation.
(2) Assuming 40% of IC&I waste generation is targeted material from major generators specified by the 3Rs Regulations (refer to Service Technical Appendix, Section 6.4 for detailed explanation.)

Table 8.11
Estimated IC&I Waste Diversion
for Six IC&I Systems in York Region
1996-2015

Year	Estimated Net IC&I Waste Generation (1)	Estimated Diversion (tonnes)					
		Existing System	Existing/ Committed System (2) (40% capture case)	Extended 3Rs Regulations	Expanded 3Rs Regulations	Expanded 3Rs with Organics Regulations	No Unprocessed Waste to Landfill
1996	468,936	150,059	178,196	257,915	300,119	328,255	370,459
1997	483,899	154,848	183,882	266,144	309,695	338,729	382,280
1998	499,321	159,783	189,742	274,627	319,566	349,525	394,464
1999	515,215	164,869	195,782	283,368	329,737	360,650	407,020
2000	531,593	170,110	202,005	292,376	340,219	372,115	419,958
2001	548,468	175,510	208,418	301,658	351,020	383,928	433,290
2002	556,435	178,059	211,445	306,039	356,118	389,504	439,584
2003	564,463	180,628	214,496	310,455	361,256	395,124	445,926
2004	572,555	183,217	217,571	314,905	366,435	400,788	452,318
2005	580,707	185,826	220,669	319,389	371,652	406,495	458,758
2006	588,917	188,453	223,789	323,904	376,907	412,242	465,245
2007	597,086	191,067	226,893	328,397	382,135	417,960	471,698
2008	605,352	193,713	230,034	332,943	387,425	423,746	478,228
2009	613,718	196,390	233,213	337,545	392,779	429,602	484,837
2010	622,183	199,099	236,430	342,201	398,197	435,528	491,525
2011	630,749	201,840	239,685	346,912	403,679	441,524	498,292
2012	634,500	203,040	241,110	348,975	406,080	444,150	501,255
2013	638,257	204,242	242,538	351,041	408,484	446,780	504,223
2014	642,183	205,498	244,029	353,201	410,997	449,528	507,324
2015	646,118	206,758	245,525	355,365	413,515	452,283	510,433
Total	**11,540,654**	**3,693,009**	**4,385,448**	**6,347,360**	**7,386,018**	**8,078,458**	**9,117,116**

(1) Refer to Table 8.5 for derivation of net IC&I waste generation.
(2) Assuming 40% of IC&I waste generation is targeted material from major generators specified by the 3Rs Regulations (refer to Service Technical Appendix, Section 6.4 for detailed explanation.)

Table 8.12
Estimated IC&I Waste Diversion
for Six IC&I Systems in Peel Region
1996-2015

Year	Estimated Net IC&I Waste Generation (1)	Estimated Diversion (tonnes)					
		Existing System	Existing/ Committed System (2) (40% capture case)	Extended 3Rs Regulations	Expanded 3Rs Regulations	Expanded 3Rs with Organics Regulations	No Unprocessed Waste to Landfill
1996	683,788	218,812	259,839	376,083	437,624	478,652	540,193
1997	688,389	220,285	261,588	378,614	440,569	481,872	543,827
1998	692,979	221,753	263,332	381,138	443,506	485,085	547,453
1999	697,569	223,222	265,076	383,663	446,444	488,299	551,080
2000	702,146	224,687	266,816	386,181	449,374	491,503	554,696
2001	706,712	226,148	268,551	388,692	452,296	494,699	558,303
2002	711,265	227,605	270,281	391,196	455,210	497,886	561,899
2003	715,806	229,058	272,006	393,694	458,116	501,065	565,487
2004	720,332	230,506	273,726	396,183	461,013	504,232	569,062
2005	724,842	231,950	275,440	398,663	463,899	507,390	572,625
2006	729,335	233,387	277,147	401,134	466,774	510,535	576,175
2007	733,809	234,819	278,847	403,595	469,638	513,666	579,709
2008	738,264	236,244	280,540	406,045	472,489	516,785	583,228
2009	742,697	237,663	282,225	408,483	475,326	519,888	586,730
2010	747,107	239,074	283,901	410,909	478,149	522,975	590,215
2011	729,335	233,387	277,147	401,134	466,774	510,535	576,175
2012	733,809	234,819	278,847	403,595	469,638	513,666	579,709
2013	738,264	236,244	280,540	406,045	472,489	516,785	583,228
2014	742,697	237,663	282,225	408,483	475,326	519,888	586,730
2015	747,107	239,074	283,901	410,909	478,149	522,975	590,215
Total	**14,426,254**	**4,616,401**	**5,481,977**	**7,934,440**	**9,232,803**	**10,098,378**	**11,396,741**

(1) Refer to Table 8.5 for derivation of net IC&I waste generation.
(2) Assuming 40% of IC&I waste generation is targeted material from major generators specified by the 3Rs Regulations (refer to Service Technical Appendix, Section 6.4 for detailed explanation.)

Table 8.13
Estimated IC&I Waste Disposal Requirements
for Six IC&I Systems in Durham Region
1996-2015

Year	Estimated Net IC&I Waste Generation (1)	Estimated Disposal Requirements (tonnes)					
		Existing System	Existing/ Committed System (2) (40% capture case)	Extended 3Rs Regulations	Expanded 3Rs Regulations	Expanded 3Rs with Organics Regulations	No Unprocessed Waste to Landfill
1996	218,821	148,798	135,669	98,469	78,776	65,646	45,952
1997	223,894	152,248	138,814	100,752	80,602	67,168	47,018
1998	229,073	155,770	142,025	103,083	82,466	68,722	48,105
1999	234,361	159,366	145,304	105,463	84,370	70,308	49,216
2000	239,761	163,037	148,652	107,892	86,314	71,928	50,350
2001	245,274	166,786	152,070	110,373	88,299	73,582	51,508
2002	248,089	168,701	153,815	111,640	89,312	74,427	52,099
2003	250,922	170,627	155,572	112,915	90,332	75,277	52,694
2004	253,769	172,563	157,337	114,196	91,357	76,131	53,291
2005	256,630	174,509	159,111	115,484	92,387	76,989	53,892
2006	259,506	176,464	160,894	116,778	93,422	77,852	54,496
2007	262,395	178,428	162,685	118,078	94,462	78,718	55,103
2008	265,297	180,402	164,484	119,384	95,507	79,589	55,712
2009	268,212	182,384	166,291	120,695	96,556	80,463	56,324
2010	271,138	184,374	168,105	122,012	97,610	81,341	56,939
2011	274,075	186,371	169,926	123,334	98,667	82,222	57,556
2012	274,344	186,554	170,094	123,455	98,764	82,303	57,612
2013	274,593	186,723	170,248	123,567	98,854	82,378	57,665
2014	274,819	186,877	170,388	123,669	98,935	82,446	57,712
2015	275,024	187,016	170,515	123,761	99,009	82,507	57,755
Total	5,099,996	3,467,997	3,161,998	2,294,998	1,835,999	1,529,999	1,070,999

(1) Refer to Table 8.5 for derivation of net IC&I waste generation.
(2) Assuming 40% of IC&I waste generation is targeted material from major generators specified by the 3Rs Regulations (refer to Service Technical Appendix, Section 6.4 for detailed explanation.)

Table 8.14
Estimated IC&I Waste Disposal Requirements
for Six IC&I Systems in Metro Toronto
1996-2015

Year	Estimated Net IC&I Waste Generation (1)	Estimated Disposal Requirements (tonnes)					
		Existing System	Existing/ Committed System (2) (40% capture case)	Extended 3Rs Regulations	Expanded 3Rs Regulations	Expanded 3Rs with Organics Regulations	No Unprocessed Waste to Landfill
1996	1,603,254	1,090,212	994,017	721,464	577,171	480,976	336,683
1997	1,604,766	1,091,241	994,955	722,145	577,716	481,430	337,001
1998	1,606,185	1,092,206	995,835	722,783	578,227	481,855	337,299
1999	1,607,510	1,093,107	996,656	723,379	578,704	482,253	337,577
2000	1,608,738	1,093,942	997,418	723,932	579,146	482,622	337,835
2001	1,609,869	1,094,711	998,118	724,441	579,553	482,961	338,072
2002	1,603,642	1,090,476	994,258	721,639	577,311	481,093	336,765
2003	1,597,270	1,086,144	990,308	718,772	575,017	479,181	335,427
2004	1,590,752	1,081,711	986,266	715,838	572,671	477,226	334,058
2005	1,584,086	1,077,178	982,133	712,839	570,271	475,226	332,658
2006	1,577,269	1,072,543	977,907	709,771	567,817	473,181	331,226
2007	1,578,796	1,073,581	978,853	710,458	568,366	473,639	331,547
2008	1,580,279	1,074,590	979,773	711,125	568,900	474,084	331,859
2009	1,581,715	1,075,566	980,663	711,772	569,418	474,515	332,160
2010	1,583,105	1,076,512	981,525	712,397	569,918	474,932	332,452
2011	1,584,450	1,077,426	982,359	713,002	570,402	475,335	332,734
2012	1,585,746	1,078,307	983,163	713,586	570,869	475,724	333,007
2013	1,586,994	1,079,156	983,936	714,147	571,318	476,098	333,269
2014	1,588,194	1,079,972	984,680	714,687	571,750	476,458	333,521
2015	1,589,344	1,080,754	985,393	715,205	572,164	476,803	333,762
Total	**31,851,963**	**21,659,335**	**19,748,217**	**14,333,383**	11,466,707	9,555,589	6,688,912

(1) Refer to Table 8.5 for derivation of net IC&I waste generation.
(2) Assuming 40% of IC&I waste generation is targeted material from major generators specified by the 3Rs Regulations (refer to Service Technical Appendix, Section 6.4 for detailed explanation.)

Table 8.15
Estimated IC&I Waste Disposal Requirements
for Six IC&I Systems in York Region
1996-2015

Year	Estimated Net IC&I Waste Generation (1)	Estimated Disposal Requirements (tonnes)					
		Existing System	Existing/ Committed System (2) (40% capture case)	Extended 3Rs Regulations	Expanded 3Rs Regulations	Expanded 3Rs with Organics Regulations	No Unprocessed Waste to Landfill
1996	468,936	318,876	290,740	211,021	168,817	140,681	98,477
1997	483,899	329,051	300,017	217,755	174,204	145,170	101,619
1998	499,321	339,539	309,579	224,695	179,756	149,796	104,858
1999	515,215	350,346	319,433	231,847	185,477	154,564	108,195
2000	531,593	361,483	329,587	239,217	191,373	159,478	111,634
2001	548,468	372,959	340,050	246,811	197,449	164,541	115,178
2002	556,435	378,376	344,990	250,396	200,317	166,930	116,851
2003	564,463	383,835	349,967	254,008	203,207	169,339	118,537
2004	572,555	389,337	354,984	257,650	206,120	171,766	120,236
2005	580,707	394,881	360,038	261,318	209,054	174,212	121,948
2006	588,917	400,464	365,129	265,013	212,010	176,675	123,673
2007	597,086	406,018	370,193	268,689	214,951	179,126	125,388
2008	605,352	411,639	375,318	272,408	217,927	181,606	127,124
2009	613,718	417,328	380,505	276,173	220,938	184,115	128,881
2010	622,183	423,085	385,754	279,982	223,986	186,655	130,658
2011	630,749	428,909	391,064	283,837	227,070	189,225	132,457
2012	634,500	431,460	393,390	285,525	228,420	190,350	133,245
2013	638,257	434,015	395,719	287,216	229,772	191,477	134,034
2014	642,183	436,684	398,153	288,982	231,186	192,655	134,858
2015	646,118	439,360	400,593	290,753	232,602	193,835	135,685
Total	**11,540,654**	**7,847,645**	**7,155,205**	**5,193,294**	**4,154,635**	**3,462,196**	**2,423,537**

(1) Refer to Table 8.5 for derivation of net IC&I waste generation.
(2) Assuming 40% of IC&I waste generation is targeted material from major generators specified by the 3Rs Regulations (refer to Service Technical Appendix, Section 6.4 for detailed explanation.)

Table 8.16
Estimated IC&I Waste Disposal Requirements
for Six IC&I Systems in Peel Region
1996-2015

Year	Estimated Net IC&I Waste Generation (1)	Estimated Disposal Requirements (tonnes)					
		Existing System	Existing/ Committed System (2) (40% capture case)	Extended 3Rs Regulations	Expanded 3Rs Regulations	Expanded 3Rs with Organics Regulations	No Unprocessed Waste to Landfill
1996	616,169	418,995	382,025	277,276	221,821	184,851	129,396
1997	629,179	427,842	390,091	283,131	226,504	188,754	132,128
1998	642,441	436,860	398,314	289,099	231,279	192,732	134,913
1999	655,960	446,053	406,695	295,182	236,146	196,788	137,752
2000	681,762	463,598	422,692	306,793	245,434	204,528	143,170
2001	683,788	464,976	423,949	307,705	246,164	205,136	143,596
2002	688,389	468,105	426,801	309,775	247,820	206,517	144,562
2003	692,979	471,226	429,647	311,840	249,472	207,894	145,526
2004	697,569	474,347	432,493	313,906	251,125	209,271	146,490
2005	702,146	477,460	435,331	315,966	252,773	210,644	147,451
2006	706,712	480,564	438,162	318,021	254,416	212,014	148,410
2007	711,265	483,660	440,984	320,069	256,055	213,380	149,366
2008	715,806	486,748	443,800	322,113	257,690	214,742	150,319
2009	720,332	489,826	446,606	324,149	259,320	216,100	151,270
2010	724,842	492,893	449,402	326,179	260,943	217,453	152,217
2011	729,335	495,948	452,188	328,201	262,561	218,801	153,160
2012	733,809	498,990	454,962	330,214	264,171	220,143	154,100
2013	738,264	502,019	457,724	332,219	265,775	221,479	155,035
2014	742,697	505,034	460,472	334,213	267,371	222,809	155,966
2015	747,107	508,033	463,207	336,198	268,959	224,132	156,893
Total	**13,960,553**	**9,493,176**	**8,655,543**	**6,282,249**	**5,025,799**	**4,188,166**	**2,931,716**

(1) Refer to Table 8.5 for derivation of net IC&I waste generation.
(2) Assuming 40% of IC&I waste generation is targeted material from major generators specified by the 3Rs Regulations (refer to Service Technical Appendix, Section 6.4 for detailed explanation.)

Metro Toronto, York, Metro and York combined, and Peel. The results are discussed on a regional basis in sections 8.4.1 to 8.4.5.

A number of points should be noted regarding the information presented in tables 8.17 to 8.21. Firstly, the diversion percentages shown in these tables are the **cumulative diversion achieved over a twenty year period, from 1996 to 2015.** These are different from the values presented in the summary net effects tables presented in Chapter 7, and discussed in Chapter 4 (for residential) and Chapter 6 (for IC&I). The summary net effects tables show a **one year snapshot** of the diversion that could be achieved by any of the residential systems at a regional level, and the IC&I systems at the GTA level **in the year 2000**, assuming that the system in question is fully operational in the year 2000, and has achieved a 5% source reduction value, measured against a 1992 level. The two sets of numbers are different, and should not be confused with one another.

Secondly, the source reduction assumptions used in each residential and IC&I system are the same, therefore the cumulative twenty year reduction (which varied from 8% to 9%) will be the same for all system combinations on a regional basis. The slight difference in the cumulative source reduction estimate from one region to another is related to slight differences in the IC&I source reduction value which results from long term changes in the employment profiles of different regions.

The resulting 20 year cumulative diversion estimates are discussed by region in the following sections.

8.4.1. Region of Durham

Table 8.17 shows that the 25 combinations of residential and IC&I systems can divert a range of 4 million to 8.2 million tonnes of waste in Region of Durham between 1996 and 2015. This translates to 41% to 83% of the Durham waste stream. At the low end of the range, the combination of Existing/Committed residential and IC&I systems divert an estimated 41% of the waste generated between 1996 and 2015, by the year 2015. This totals 4 million tonnes of diversion in the twenty year period, made up of an estimated 3.1 million tonnes (32%) of waste reused/recycled, and 0.9 million tonnes (9%) of waste reduced. Other combinations of residential and IC&I systems achieve higher diversions. The highest potential diversion is achieved by the combination of mixed waste processing of residential waste (with marketing of finished compost), and a policy of no unprocessed waste to landfill for IC&I waste. This combination could reasonably divert 7.4 to 8.2 million tonnes (75% to 83%) in the twenty year period. The range relates to the quality of the finished compost from the mixed waste plant, and whether it can be classified for unrestricted use.

Of the 25 system combinations considered, 22 could reasonably achieve diversion of at least 50% of waste generated over the 20 year planning period. Almost one

Table 8.17
Summary of Diversion Data for
Combinations of Residential and IC&I Systems

Region of Durham

Scenario		Cumulative Diversion (2015)									
		Reduction		Reuse/Recycling				Total Diversion			
Residential	IC&I	%	tonnes (millions)	% Low	% High	tonnes (millions) Low	tonnes (millions) High	% Low	% High	tonnes (millions) Low	tonnes (millions) High
Existing/ Committed	Existing/ Committed	9%	0.90	32%		3.10		41%		4.00	
	Extended 3Rs	9%	0.90	40%		3.97		50%		4.87	
	Expanded 3Rs	9%	0.90	45%		4.43		54%		5.32	
	Expanded 3Rs with Organics	9%	0.90	48%		4.73		57%		5.63	
	No Unprocessed Waste to Landfill	9%	0.90	53%		5.19		62%		6.09	
Direct Cost	Existing/ Committed	9%	0.90	38%	40%	3.74	3.96	47%	49%	4.63	4.86
	Extended 3Rs	9%	0.90	47%	49%	4.60	4.83	56%	58%	5.50	5.72
	Expanded 3Rs	9%	0.90	52%	54%	5.06	5.29	61%	63%	5.96	6.18
	Expanded 3Rs with Organics	9%	0.90	55%	57%	5.37	5.59	64%	66%	6.27	6.49
	No Unprocessed Waste to Landfill	9%	0.90	59%	62%	5.83	6.05	68%	71%	6.73	6.95
Expanded Blue Box	Existing/ Committed	9%	0.90	40%	43%	3.94	4.26	49%	52%	4.83	5.16
	Extended 3Rs	9%	0.90	49%	52%	4.80	5.13	58%	61%	5.70	6.02
	Expanded 3Rs	9%	0.90	54%	57%	5.26	5.59	63%	66%	6.16	6.48
	Expanded 3Rs with Organics	9%	0.90	57%	60%	5.57	5.89	66%	69%	6.47	6.79
	No Unprocessed Waste to Landfill	9%	0.90	61%	65%	6.03	6.35	70%	74%	6.92	7.25
Wet/Dry	Existing/ Committed	9%	0.90	46%	47%	4.50	4.61	55%	56%	5.39	5.50
	Extended 3Rs	9%	0.90	55%	56%	5.36	5.47	64%	65%	6.26	6.37
	Expanded 3Rs	9%	0.90	59%	60%	5.82	5.93	68%	69%	6.72	6.83
	Expanded 3Rs with Organics	9%	0.90	62%	63%	6.13	6.24	71%	73%	7.03	7.14
	No Unprocessed Waste to Landfill	9%	0.90	67%	68%	6.59	6.70	76%	77%	7.49	7.59
Mixed Waste Processing	Existing/ Committed	9%	0.90	45%	53%	4.43	5.21	54%	62%	5.32	6.11
	Extended 3Rs	9%	0.90	54%	62%	5.29	6.08	63%	71%	6.19	6.98
	Expanded 3Rs	9%	0.90	59%	67%	5.75	6.54	68%	76%	6.65	7.44
	Expanded 3Rs with Organics	9%	0.90	62%	70%	6.06	6.85	71%	79%	6.95	7.74
	No Unprocessed Waste to Landfill	9%	0.90	66%	74%	6.52	7.30	75%	83%	7.41	8.20

fifth (9% of the waste stream) of the estimated diversion is assumed to occur through source reduction, which would be feasible if a sustained promotion, education, and support program focussed on source reduction by both the residential and IC&I sectors.

8.4.2. Metro Toronto

Table 8.18 shows that the 25 combinations of residential and IC&I systems could divert a range of 22.8 million to 48.3 million tonnes of waste in Metro Toronto between 1996 and 2015. This translates to 38% to 81% of the Metro Toronto waste stream. At the low end of the range, the combination of Existing/Committed residential and IC&I systems divert an estimated 38% of the waste generated between 1996 and 2015, by the year 2015. This totals 22.8 million tonnes of diversion in the twenty year period, made up of an estimated 17.2 million tonnes (29%) of waste reused/recycled, and 5.6 million tonnes (9%) of waste reduced. Other combinations of residential and IC&I systems could reasonably achieve higher diversions. The highest potential diversion is achieved by the combination of mixed waste processing of residential waste (with marketing of finished compost), and a policy of no unprocessed waste to landfill for IC&I waste. This combination could reasonably divert 43.5 to 48.3 million tonnes (73% to 81%) in the twenty year period. The range relates to the quality of the finished compost from the mixed waste plant, and whether it can be classified for unrestricted use.

Of the 25 system combinations considered, 20 could reasonably achieve diversion of at least 50% of waste generated over the 20 year planning period. Almost one fifth (9% of the waste stream) of the estimated diversion is assumed to occur through source reduction, which would be feasible if a sustained promotion, education, and support program focussed on source reduction by both the residential and IC&I sectors.

8.4.3. Region of York

Table 8.19 shows that the 25 combinations of residential and IC&I systems could divert a range of 7.6 to million to 15.1 million tonnes of waste in Region of York between 1996 and 2015. This translates to 42% to 83% of the Region of York waste stream. At the low end of the range, the combination of Existing/Committed residential and IC&I systems divert an estimated 42% of the waste generated between 1996 and 2015, by the year 2015. This totals 7.6 million tonnes of diversion in the twenty year period, made up of an estimated 5.9 million tonnes (33%) of waste reused/recycled, and 1.7 million tonnes (9%) of waste reduced. Other combinations of residential and IC&I systems achieve higher diversions. The highest potential diversion is achieved by the combination of mixed waste processing of residential waste (with marketing of finished compost), and a policy of no unprocessed waste to landfill for IC&I waste. This combination could reasonably to divert 14.1 to 15.1 million tonnes

Table 8.18
Summary of Diversion Data for
Combinations of Residential and IC&I Systems

Metro Toronto

Scenario		Cumulative Diversion (2015)									
		Reduction		Reuse/Recycling				Total Diversion			
Residential	IC&I	%	tonnes (millions)	%		tonnes (millions)		%		tonnes (millions)	
				Low	High	Low	High	Low	High	Low	High
Existing/ Committed	Existing/ Committed	9%	5.63	29%		17 14		38%		22.77	
	Extended 3Rs	9%	5.63	38%		22 52		47%		28.16.	
	Expanded 3Rs	9%	5.63	43%		25 37		52%		31.01	
	Expanded 3Rs with Organics	9%	5.63	46%		27.27		55%		32.91	
	No Unprocessed Waste to Landfill	9%	5.63	51%		30.12		60%		35.76	
Direct Cost	Existing/ Committed	9%	5.63	34%	37%	19.95	22.08	43%	47%	25.58	27.72
	Extended 3Rs	9%	5.63	43%	46%	25.33	27 47	52%	56%	30.97	33.10
	Expanded 3Rs	9%	5.63	48%	51%	28.18	30.32	57%	61%	33.82	35.95
	Expanded 3Rs with Organics	9%	5 63	51%	54%	30.08	32 22	60%	64%	35.72	37.85
	No Unprocessed Waste to Landfill	9%	5.63	56%	59%	32.93	35.07	65%	69%	38.57	40.70
Expanded Blue Box	Existing/ Committed	9%	5 63	35%	40%	20.91	23.51	45%	49%	26.54	29.14
	Extended 3Rs	9%	5.63	44%	49%	26.29	28.89	54%	58%	31.93	34.53
	Expanded 3Rs	9%	5.63	49%	54%	29 14	31.74	59%	63%	34.78	37.38
	Expanded 3Rs with Organics	9%	5.63	52%	57%	31.04	33.64	62%	66%	36 68	39.28
	No Unprocessed Waste to Landfill	9%	5.63	57%	62%	33.90	36 49	67%	71%	39.53	42.13
Wet/Dry	Existing/ Committed	9%	5.63	40%	45%	23.65	26.76	49%	55%	29.29	32.40
	Extended 3Rs	9%	5.63	49%	54%	29.04	32.15	58%	64%	34.67	37.78
	Expanded 3Rs	9%	5.63	54%	59%	31.89	35.00	63%	68%	37.52	40.63
	Expanded 3Rs with Organics	9%	5.63	57%	62%	33.79	36.90	66%	72%	39.42	42.53
	No Unprocessed Waste to Landfill	9%	5.63	62%	67%	36.64	39.75	71%	77%	42.27	45.38
Mixed Waste Processing	Existing/ Committed	9%	5.63	42%	50%	24.86	29.68	51%	60%	30.50	35.31
	Extended 3Rs	9%	5 63	51%	59%	30.25	35.06	60%	69%	35.88	40.69
	Expanded 3Rs	9%	5.63	56%	64%	33.10	37.91	65%	73%	38.73	43.54
	Expanded 3Rs with Organics	9%	5.63	59%	67%	35.00	39.81	68%	77%	40.63	45.45
	No Unprocessed Waste to Landfill	9%	5 63	64%	72%	37.85	42 66	73%	81%	43 48	48 30

Table 8.19
Summary of Diversion Data for
Combinations of Residential and IC&I Systems

Region of York

Scenario		Cumulative Diversion (2015)									
		Reduction		Reuse/Recycling				Total Diversion			
Residential	IC&I	%	tonnes (millions)	% Low	% High	tonnes (millions) Low	tonnes (millions) High	% Low	% High	tonnes (millions) Low	tonnes (millions) High
Existing/ Committed	Existing/ Committed	9%	1.67	33%		5.94		42%		7.61	
	Extended 3Rs	9%	1.67	43%		7.89		52%		9.56	
	Expanded 3Rs	9%	1.67	49%		8.92		58%		10.59	
	Expanded 3Rs with Organics	9%	1.67	53%		9.61		62%		11.28	
	No Unprocessed Waste to Landfill	9%	1.67	58%		10.65		67%		12.32	
Direct Cost	Existing/ Committed	9%	1.67	37%	39%	6.81	7.15	46%	48%	8.48	8.82
	Extended 3Rs	9%	1.67	48%	50%	8.76	9.10	57%	59%	10.43	10.77
	Expanded 3Rs	9%	1.67	54%	55%	9.80	10.14	63%	65%	11.47	11.81
	Expanded 3Rs with Organics	9%	1.67	57%	59%	10.49	10.83	67%	68%	12.16	12.50
	No Unprocessed Waste to Landfill	9%	1.67	63%	65%	11.52	11.86	72%	74%	13.19	13.53
Expanded Blue Box	Existing/ Committed	9%	1.67	39%	41%	7.06	7.49	48%	50%	8.73	9.16
	Extended 3Rs	9%	1.67	49%	52%	9.01	9.44	58%	61%	10.68	11.11
	Expanded 3Rs	9%	1.67	55%	57%	10.05	10.47	64%	66%	11.72	12.14
	Expanded 3Rs with Organics	9%	1.67	59%	61%	10.74	11.16	68%	70%	12.41	12.83
	No Unprocessed Waste to Landfill	9%	1.67	64%	67%	11.77	12.19	74%	76%	13.44	13.86
Wet/Dry	Existing/ Committed	9%	1.67	42%	44%	7.75	7.99	52%	53%	9.42	9.66
	Extended 3Rs	9%	1.67	53%	54%	9.70	9.94	62%	64%	11.37	11.61
	Expanded 3Rs	9%	1.67	59%	60%	10.73	10.98	68%	69%	12.40	12.65
	Expanded 3Rs with Organics	9%	1.67	63%	64%	11.42	11.66	72%	73%	13.09	13.34
	No Unprocessed Waste to Landfill	9%	1.67	68%	70%	12.45	12.70	77%	79%	14.12	14.37
Mixed Waste Processing	Existing/ Committed	9%	1.67	42%	48%	7.71	8.75	51%	57%	9.38	10.42
	Extended 3Rs	9%	1.67	53%	59%	9.66	10.70	62%	68%	11.33	12.37
	Expanded 3Rs	9%	1.67	59%	64%	10.69	11.74	68%	73%	12.36	13.41
	Expanded 3Rs with Organics	9%	1.67	62%	68%	11.38	12.42	71%	77%	13.05	14.09
	No Unprocessed Waste to Landfill	9%	1.67	68%	74%	12.41	13.46	77%	83%	14.08	15.13

(77% to 83% of the waste stream) in the twenty year period. The range relates to the quality of the finished compost from the mixed waste plant, and whether it can be classified for unrestricted use.

Of the 25 system combinations considered, 22 could reasonably achieve diversion of at least 50% of waste generated over the 20 year planning period. Almost one-fifth (9% of the waste stream) of the estimated diversion is assumed to occur through source reduction, which could be feasible if a sustained promotion, education, and support program focusses on source reduction by both the residential and IC&I sectors.

8.4.4. Metro Toronto and Region of York combined

Table 8.20 shows that the 25 combinations of residential and IC&I systems could divert a range of 30.4 to million to 63.4 million tonnes of waste in Metro Toronto and Region of York combined between 1996 and 2015. This translates to 39% to 82% of the combined waste stream from the two regions, which make up one service area. At the low end of the range, the combination of Existing/Committed residential and IC&I systems divert an estimated 39 % of the waste generated between 1996 and 2015, by the year 2015. This totals 30.4 million tonnes of diversion in the twenty year period, made up of an estimated 23.1 million tonnes (30%) of waste reused/recycled, and 7.3 million tonnes (9%) of waste reduced. Other combinations of residential and IC&I systems achieve higher diversions. The highest potential diversion is achieved by the combination of mixed waste processing of residential waste (with marketing of finished compost), and a policy of no unprocessed waste to landfill for IC&I waste. This combination could reasonably divert 57.6 to 63.4 million tonnes (74% to 82%) in the twenty year period. The range relates to the quality of the finished compost from the mixed waste plant, and whether it can be classified for unrestricted use.

Of the 25 system combinations considered, 21 could reasonably achieve diversion of at least 50% of waste generated over the 20 year planning period. Almost one fifth (9% of the waste stream) of the estimated diversion is assumed to occur through source reduction which would be feasible if a sustained promotion, education, and support program focussed on source reduction by both the residential and IC&I sectors.

8.4.5. Region of Peel

Table 8.21 shows that the 25 combinations of residential and IC&I systems could divert a range of 9.4 million to 19.6 million tonnes of waste in Region of Peel between 1996 and 2015. This translates to 40% to 82% of the Region of Peel waste stream. At the low end of the range, the combination of Existing/Committed residential and IC&I systems divert an estimated 40% of the waste generated between 1996 and 2015, by the year 2015. This totals 9.4 million tonnes of

Table 8.20
Summary of Diversion Data for
Combinations of Residential and IC&I Systems

Combination of Metro Toronto and York Region

Scenario		Cumulative Diversion (2015)									
		Reduction		Reuse/Recycling				Total Diversion			
Residential	IC&I	%	tonnes (millions)	% Low	% High	tonnes (millions) Low	tonnes (millions) High	% Low	% High	tonnes (millions) Low	tonnes (millions) High
Existing/ Committed	Existing/ Committed	9%	7.30	30%		23 08		39%		30.38	
	Extended 3Rs	9%	7.30	39%		30 41		49%		37 72	
	Expanded 3Rs	9%	7.30	44%		34 30		54%		41 60	
	Expanded 3Rs with Organics	9%	7 30	48%		36.89		57%		44 19	
	No Unprocessed Waste to Landfill	9%	7.30	53%		40 77		62%		48 07	
Direct Cost	Existing/ Committed	9%	7 30	34%	38%	26 76	29 24	44%	47%	34.07	36.54
	Extended 3Rs	9%	7.30	44%	47%	34.10	36 57	53%	57%	41 40	43 88
	Expanded 3Rs	9%	7 30	49%	52%	37 98	40 46	58%	62%	45.28	47 76
	Expanded 3Rs with Organics	9%	7.30	52%	55%	40 57	43 05	62%	65%	47 87	50 35
	No Unprocessed Waste to Landfill	9%	7.30	57%	60%	44.45	46 93	67%	70%	51.76	54.23
Expanded Blue Box	Existing/ Committed	9%	7.30	36%	40%	27.97	31.00	45%	49%	35.28	38.30
	Extended 3Rs	9%	7.30	46%	49%	35 31	38 33	55%	59%	42.61	45 64
	Expanded 3Rs	9%	7 30	51%	54%	39 19	42 22	60%	64%	46.50	49 52
	Expanded 3Rs with Organics	9%	7 30	54%	58%	41 78	44 80	63%	67%	49.09	52 11
	No Unprocessed Waste to Landfill	9%	7 30	59%	63%	45 66	48 69	68%	72%	52 97	55 99
Wet/Dry	Existing/ Committed	9%	7 30	40%	45%	31 40	34 75	50%	54%	38 71	42.06
	Extended 3Rs	9%	7.30	50%	54%	38.74	42 09	59%	64%	46 04	49 39
	Expanded 3Rs	9%	7.30	55%	59%	42.62	45 97	64%	69%	49.93	53.28
	Expanded 3Rs with Organics	9%	7.30	58%	63%	45.21	48 56	68%	72%	52.51	55 87
	No Unprocessed Waste to Landfill	9%	7.30	63%	68%	49 09	52.45	73%	77%	56 40	59 75
Mixed Waste Processing	Existing/ Committed	9%	7 30	42%	50%	32 57	38 43	51%	59%	39 87	45 73
	Extended 3Rs	9%	7 30	51%	59%	39 90	45 76	61%	68%	47 21	53 07
	Expanded 3Rs	9%	7 30	56%	64%	43 79	49 65	66%	73%	51 09	56 95
	Expanded 3Rs with Organics	9%	7.30	60%	67%	46 38	52 24	69%	77%	53 68	59.54
	No Unprocessed Waste to Landfill	9%	7 30	65%	72%	50 26	56 12	74%	82%	57 56	63.42

Table 8.21
Summary of Diversion Data for
Combinations of Residential and IC&I Systems

Region of Peel

Scenario		Cumulative Diversion (2015)									
		Reduction		Reuse/Recycling				Total Diversion			
Residential	IC&I	%	tonnes (millions)	% Low	% High	tonnes (millions) Low	tonnes (millions) High	% Low	% High	tonnes (millions) Low	tonnes (millions) High
Existing/ Committed	Existing/ Committed	8%	2 02	31%		7.39		40%		9.41	
	Extended 3Rs	8%	2 02	41%		9.77		49%		11.78	
	Expanded 3Rs	8%	2.02	46%		11.02		55%		13.04	
	Expanded 3Rs with Organics	8%	2.02	50%		11 86		58%		13.88	
	No Unprocessed Waste to Landfill	8%	2 02	55%		13 12		64%		15.13	
Direct Cost	Existing/ Committed	8%	2 02	36%	39%	8 68	9 29	45%	47%	10.70	11 30
	Extended 3Rs	8%	2 02	46%	49%	11.05	11 66	55%	57%	13.07	13 68
	Expanded 3Rs	8%	2.02	52%	54%	12.31	12.92	60%	63%	14 33	14.93
	Expanded 3Rs with Organics	8%	2 02	55%	58%	13 15	13.75	64%	66%	15 17	15.77
	No Unprocessed Waste to Landfill	8%	2 02	61%	63%	14.40	15.01	69%	72%	16.42	17.03
Expanded Blue Box	Existing/ Committed	8%	2 02	36%	39%	8 58	9.37	45%	48%	10.59	11.39
	Extended 3Rs	8%	2 02	46%	49%	10.95	11.74	54%	58%	12.97	13.76
	Expanded 3Rs	8%	2.02	51%	55%	12.21	13 00	60%	63%	14.22	15.02
	Expanded 3Rs with Organics	8%	2 02	55%	58%	13.05	13.84	63%	67%	15.06	15.86
	No Unprocessed Waste to Landfill	8%	2 02	60%	63%	14.30	15.10	69%	72%	16.32	17.11
Wet/Dry	Existing/ Committed	8%	2.02	42%	45%	10.03	10.81	51%	54%	12.05	12.83
	Extended 3Rs	8%	2 02	52%	55%	12.41	13.19	61%	64%	14 42	15.20
	Expanded 3Rs	8%	2.02	57%	61%	13.66	14 44	66%	69%	15 68	16.46
	Expanded 3Rs with Organics	8%	2.02	61%	64%	14 50	15 28	69%	73%	16.52	17.30
	No Unprocessed Waste to Landfill	8%	2.02	66%	69%	15 76	16 54	75%	78%	17 77	18.55
Mixed Waste Processing	Existing/ Committed	8%	2.02	42%	50%	10 04	11 88	51%	58%	12.06	13 90
	Extended 3Rs	8%	2 02	52%	60%	12.42	14 25	61%	68%	14 43	16.27
	Expanded 3Rs	8%	2.02	57%	65%	13.67	15.51	66%	74%	15 69	17.53
	Expanded 3Rs with Organics	8%	2.02	61%	69%	14.51	16.35	69%	77%	16.53	18 36
	No Unprocessed Waste to Landfill	8%	2.02	66%	74%	15.77	17.60	75%	82%	17 78	19.62

diversion in the twenty year period, made up of an estimated 7.4 million tonnes (31%) of waste reused/recycled, and 2.0 million tonnes (8%) of waste reduced. Other combinations of residential and IC&I systems achieve higher diversions. The highest potential diversion is achieved by the combination of mixed waste processing of residential waste (with marketing of finished compost), and a policy of no unprocessed waste to landfill for IC&I waste. This combination could reasonably divert 17.78 to 19.62 million tonnes (75% to 82%) in the twenty year period. The range relates to the quality of the finished compost from the mixed waste plant, and whether it can be classified for unrestricted use.

Of the 25 system combinations considered, 21 could reasonably achieve diversion of at least 50% of waste generated over the 20 year planning period. A portion (8% of the waste stream) of the estimated diversion is assumed to occur through source reduction, which could be feasible if a sustained promotion, education, and support program focussed on source reduction by both the residential and IC&I sectors.

8.5. Conclusion

The diversion impacts of a range of residential and IC&I systems were estimated for the three service areas for which landfills are proposed by the Interim Waste Authority. The estimates show that of the 25 combinations considered, at least 21 could reasonably divert 50% or more of the generated waste stream in the 20 year period between 1996 and 2015. All estimates have assumed that up to one-fifth of the diversion will be achieved through source reduction by the residential and IC&I sectors. A sustained promotion, education and support program for source reduction would help achieve this result.

The actual level of waste diversion achieved in each of the primary service areas will be influenced by a number of factors including the diversion approach pursued in each Region as well as external influences. These external influences will impact on both the generation and diversion of waste by the residential and IC&I sectors. The external influences include factors such as economic growth, our international competitiveness, the value of the Canadian dollar, the continued availability of an inexpensive export option for waste disposal, and the creation of stable sustainable end markets for secondary materials